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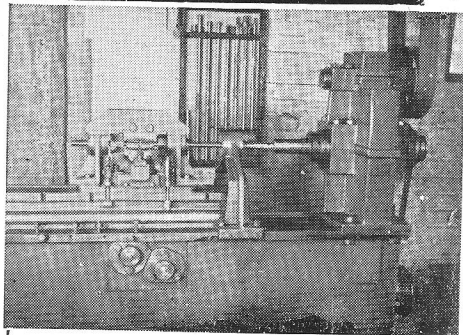
THE MODEL ENGINEER

HILAND CLASSIC INSIDE VALUOS

Vol. 94 No. 2354 THURSDAY JUNE 20 1946 6d
6 FAR.



Among the many letters which have come to hand in the course of correspondence anent left-handed mechanics, is one from Mr. R. Elliott of London, S.E.2, who, although he is left-handed, has built some $\frac{3}{4}$ -in. scale, $3\frac{1}{2}$ -in. gauge tramcars, one of which is illustrated in this photograph. We hope to describe and illustrate others at a later date



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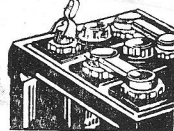
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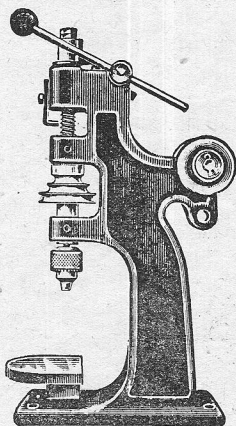
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THE MODEL ENGINEER

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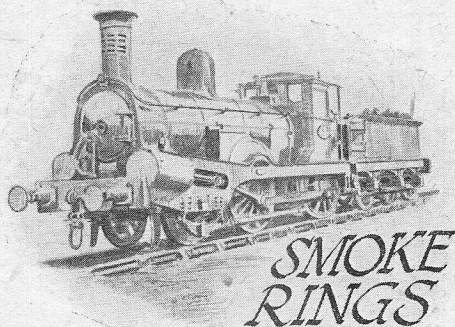
JUNE 20th, 1946

A Dream Comes True

FOR some time past the members of the Birmingham Society have in odd moments dreamed of a permanent outdoor home with full facilities for locomotive tracks, power-boating, and traction-engine running. A fanciful but very pleasant dream, with apparently remote possibilities of being realised. Yet to everybody's surprise, it has suddenly come true, thanks to the generosity of Mr. D. Campbell, the father of one of the members. The Hon. Secretary, Mr. W. H. Kesterton, tells me that Mr. Campbell has purchased what was a level sports field of $3\frac{1}{2}$ acres, at 87, Horse Shoes Lane, Sheldon, complete with a well-built pavilion with accompanying amenities. He has agreed to lease the property to the Society at a nominal rental, so that railway tracks and a boating pool can be constructed, and, as a distinct novelty, a tarmac strip can be put down for running road locomotives and model cars. It has been decided to give the estate the appropriate name of Campbell Green, in honour of the Society's benefactor, and plans and specifications for its development are now being prepared. The present track of the Society is laid out on private land under a Corporation authority, but notification has been given that this will be required for building extension in the near future. The Society has been looking out for a new site for some time past, but has encountered many difficulties. Mr. Campbell has solved the problem for them in a most generous fashion, and when this was announced at the Society's Annual Dinner, I am told it seemed too good to be true. But it is a fact—bravo, Mr. Campbell!

A Model Theatre Show

READERS interested in the model theatre should note that the Annual Exhibition of the British Puppet and Model Theatre Guild will be held at Victory House, Leicester Square, W.C., from September 30th to October 5th. This is always a fascinating show of theatricals in miniature.



Proposed Society for Buxton

MR. LEONARD M. HOBDEY, "Westward Ho," Lightwood Road, Buxton, Derbyshire, writes to say that there is a proposal afoot to form a model railway society in the town. An inaugural meeting to test public feeling has been arranged for Thursday, June 20th, at Collinson's Café, Spring Gardens, Buxton; the proceedings

will begin at 8 p.m. It is hoped that all interested readers will make a special effort to attend; or, failing that, they should get into touch with Mr. Hobdey as soon as possible.

A Romford Re-union

IT is just eleven years ago that I attended a meeting of the Romford Model Engineering Club and had the honour of driving the last spike in their newly installed track in the grounds of the Red Triangle Club. It was a great occasion, and the excellent circular track was kept occupied till darkness fell. Now, after the temporary interruption of the war, Romford has revived, and on June 1st, the first organised post-war track meeting took place. Over sixty members and friends attended, and from 3 p.m. to 6 p.m., there was a non-stop programme of locomotive running, including a load-hauling contest. During the evening, Mr. Frank E. Markham, the Hon. Secretary, put his "Consolidation" under steam for the second time and invited some of the beginners who are building their first loco to take a turn at driving. They were highly delighted with their first experience at the throttle. On her last run, "Consolidation" took all the available trucks with a living load of 8 cwt. 23 lb. Mr. Markham says this performance surprised him as well as the novices, for the two cylinders measured only $\frac{11}{16}$ -in. bore by $1\frac{1}{4}$ -in. stroke, and the boiler was not pressed beyond 60 lb.

Percival Marshall

THE "M.E." SENSITIVE

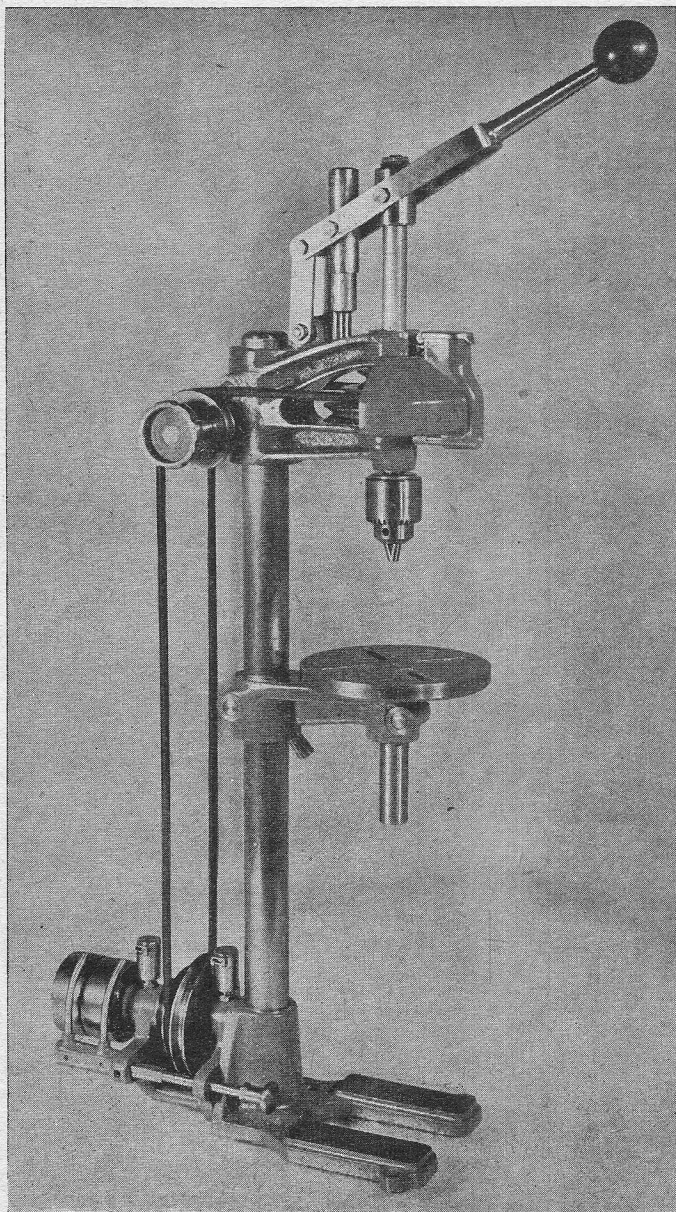
DRILLING MACHINE

Some suggestions for detail improvements in this machine, and hints on how to use it to the best advantage

by "NED"

THE light drilling machine described in THE MODEL ENGINEER during the year 1941 has proved to be a popular tool among model engineers, many of whom have built it either in the exact form described, or with various detail modifications to suit their own requirements or preferences. In practically all cases it has been found satisfactory in fulfilling the particular needs of model engineering work, but in common with practically every other device, it is capable of some improvement, and by no means immune from criticism. The object of these notes is mainly to answer the criticisms which have been received, and to describe possible ways—most of which have been put into practice by various constructors—in which it can be improved, and its range of usefulness increased.

For the benefit of those readers who are not familiar with the design, it may be described as a simple "utility" machine (using the term in its literal sense, and not the modern application, which only too often is associated with shoddiness and bad workmanship), intended to be suitable for construction by the model engineer, with the aid of his one and only machine tool, the lathe, and to form a worthy helpmate to the latter when completed. These considerations necessarily imposed certain restrictions on the design, elaboration being rigorously subdued, and dimensions kept within such limits that its parts could be machined with the facilities likely to be available to those interested in its construction. It may be mentioned that the general design was based on a much earlier machine, of smaller size, and equipped with only



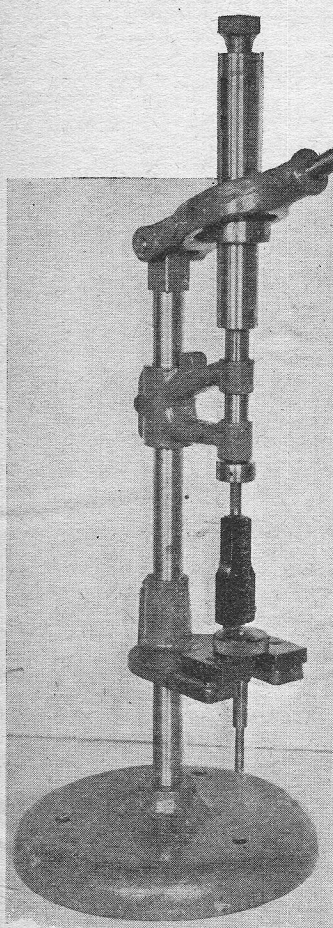
An example of the "M.E." drilling machine, with detail improvements, constructed by Mr. H. F. Wedge

a single-speed driving pulley, which had been used by the writer for over fifteen years, and had proved highly satisfactory for work within its capacity.

pects, the design is fairly orthodox, and no striking originality is apparent in any of its features. The use of a steel bar for the main column is quite common in drilling machines, both large and small, and though it has sometimes been criticised on the score of low inherent rigidity, there is little reason to believe that any appreciable deflection of the column takes place under the stresses likely to

be encountered in the normal working of the machine. These, of course, are very much lighter, and of a different order, to those produced in lathes, so that the objections often raised against round bar-bed lathes do not apply. The great practical advantage of the bar column in the present case is that it simplifies machining, especially where machine tool capacity is limited; besides which, it permits a wide scope in the axial length capacity of the machine, and facilitates the fitting of a swing table, which is extremely useful in dealing with work varying in shape and size.

The radial reach of the machine was restricted by the desirability of swinging the headstock and table arm castings in the model engineer's lathe. Quite obviously, an increase in the reach would have many practical advantages, but it is difficult to know where to stop when setting out to increase dimensions, and it was considered far more important to keep within limits which could be handled by the average constructor. In the course of five years' experience with the machine, the need for greater capacity has only



An interesting adaptation of the main castings of the machine, in a percussion marking press
(By courtesy of the Myford Engineering Co. Ltd.)

The design was arranged to be adaptable for various methods of driving, the standard equipment including provision for flat belt drive from a line shaft, with belt striking gear; but this may be varied in almost any desired manner, and direct belt drive from a motor mounted vertically at the back of the headstock is quite practicable.

In most essential res-

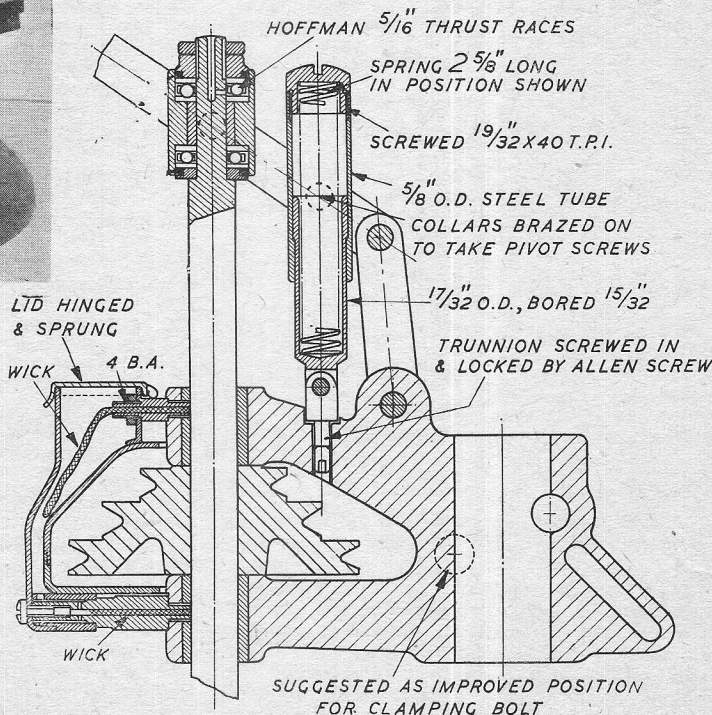


Fig. 1. The headstock of Mr. Wedge's machine, showing modified features

been seriously felt once or twice, and the work in each case has been successfully handled by other means.

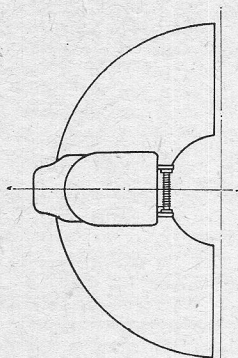


Fig. 2. Plan view of belt guard and spindle lubricator

The question of machining facilities has also influenced the design and dimensions of the soleplate casting. It has been said that the machine looks top-heavy with so small a base, but apart from the matter of appearance, the thing that really matters is whether this affects stability when the machine is secured to the bench in the normal way, by means of four screws; and so far, no trouble of any kind has been experienced. There is, of course, no objection

to mounting the soleplate on a metal sub-base or plinth if desired.

Another feature which has been the subject of some comment is the use of a sliding spindle, which is considered very much inferior to mounting the spindle in fixed bearings in a sliding "quill," as very commonly done in larger machines. The latter form of design should logically be better from the point of durability, and is therefore justified in machines intended

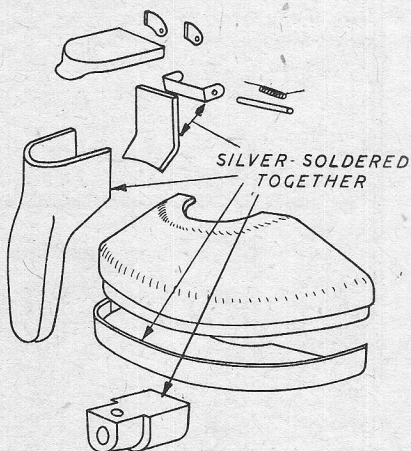


Fig. 3. How the guard and lubricator parts are fabricated

for continuous use; whether it affords more steadiness or accuracy depends almost entirely on how well it is made and fitted. It certainly entails a good deal more work, especially if the quill is provided with a rack for actuating the sliding motion. The sliding spindle type of machine has been very extensively used for light high-speed machines in the past, and has proved

entirely satisfactory; in the opinion of many users, the direct operation of the lever on the end of the spindle affords better sensitivity than that of a rack and pinion quill machine.

As the lever of the sliding spindle machine moves in an arc, some side-thrust is imposed on the spindle near the extreme ends of its travel, and theoretically, this may affect accuracy by tending to throw the drill out of truth one way or the other; but in practice, even in machines which have had considerable wear, no complaints of inaccurate drilling from this cause have been encountered. It is, of course, desirable to keep the arc of travel within reason, and also to avoid excessively long spindle travel, which would involve an undesirable overhang of the spindle beyond its bearings at extreme reach.

Practical Applications of the "M.E." Machine

Many examples of this machine have been encountered at local model engineering society exhibitions, some of them made exactly to the published drawings, but many others including modifications

and elaboration of detail. One such machine was described by Mr. T. P. Blackford in the issue of May 16th. So far as can be ascertained from enquiry of the constructors, all have behaved satisfactorily, and have proved their worth in the workshop. But the application of the machine has not been confined entirely to the amateur workshop; several machines have been built by professional users, and applied to production work with complete success. The straightforwardness of the design makes it very suitable for construction in the tool room, and in cases where small drilling machines have been difficult to obtain, or delayed delivery has held up work, it has proved well worth while to make one or more of these machines to fill the breach. Information has been received of a machine of this type which has been run at a spindle speed of 12,000 r.p.m. for a special fine drilling operation, for which no other available machine in the factory had been found suitable.

Although somewhat beside the point, so far as drilling machines are concerned, it may be permissible to illustrate an interesting adaptation of some of the main castings of the machine in the production of a percussion marking press, which has been carried out by the Myford Engineering Co. Ltd., and used for marking components in their own factory. It may be mentioned that this type of press works on the principle of an automatic centre punch. A die-stamp carrying the required number or lettering is fitted to the end of the spindle, and is brought into contact with the component to be marked by

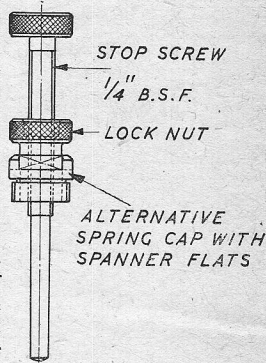


Fig. 4. Adjustable spindle stop

lowering the lever. Further depression of the lever compresses the spring of the punch mechanism (enclosed in the cylinder above the spindle), and finally releases the internal trip hammer, which strikes a blow on the end of the spindle. By arranging the device as shown, with an extended lever, it is possible to use a heavy and powerful mechanism, and to ensure accurate location and alignment of the stamp. It is also practicable to equip the press with an automatic numbering device if required.

Improvements to the "M.E." Machine

While this machine, in its standard form, is quite useful and efficient, it is, of course, quite capable of improvement in detail, and to the reader experienced in machine tool design, many small refinements will appear to be desirable. When the machine was first described, it was immediately noticed by a reader that a slight alteration to the design would enable the belt tension to be kept constant for all three speeds, which had not been provided for in the design as originally drawn. This improvement has been incorporated in the standard design, with due acknowledgments to Mr. H. Carr, who suggested it.

A further feature which has been found desirable, in the course of practical use of the machine, is a simplified means of releasing the jockey pulley spindle, which was originally secured by a nut on the inside of one of the pulleys. It was necessary to unscrew the nut to shift the spindle when changing the speed, and although this was not actually inaccessible, it entailed the use of a spanner in a rather confined space. A modification to the spindle on the writer's machine enabled the spindle to be shifted much more expeditiously, and without the use of tools, but as the same idea has been put into effect by another constructor, in a very neat and workmanlike way, it will be described in a general description of his machine.

An excellent example of the way in which detail modifications and additions can be utilised in the improvement of the machine is illustrated in the photograph of this machine, constructed by Mr. H. F. Wedge, of Knebworth. It was "discovered" by the writer at a local model engineering exhibition, and the constructor has been kind enough to furnish the photograph and detail sketches shown here.

No alteration whatever has been made to the main castings, but some details in their machining operations have been altered to suit the additions to the design. (See Fig. 1.) The most noticeable elaboration is the fitting of a very neat belt guard over the front of the headstock, and this has been ingeniously combined with a lubricating device of the wick-syphon type which supplies oil to both the spindle bearings in the headstock. Figs. 2 and 3 show the method of constructing this component, and needs very little further explanation.

Return Spring

In place of the exposed tension spring at the back of the headstock, for returning the feed lever, Mr. Wedge employs an enclosed compression spring, between the fulcrum of the lever

and the spindle head; the lever does not have to be extended at the rear end in this case.

Apart from improving the neatness of appearance, the use of a compression spring in this way has several practical advantages. Being near the fulcrum point, its travel is very short, so that the tension does not vary greatly over its full stroke, and the variation is further minimised by pre-loading. Another advantage which might possibly be obtained by enclosing the spring in a telescopic tubular casing as shown (though it has not been mentioned by Mr. Wedge), is that it could be used as a dashpot to prevent any sudden

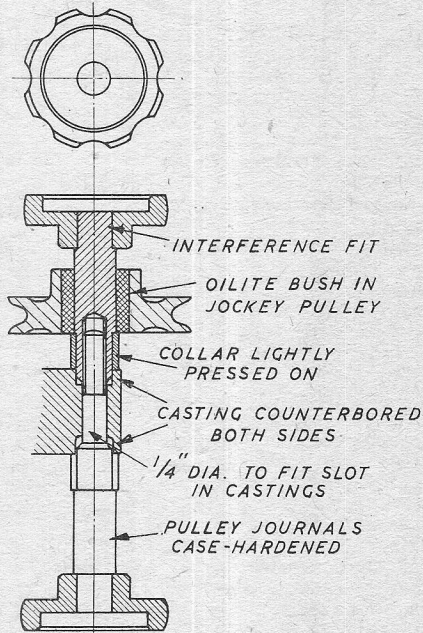


Fig. 5. Improved form of jockey pulley spindle

snatch when a drill breaks through the work unexpectedly—a prolific cause of broken drills, by the way.

The spring housing can also be fitted with the set-screw and lock-nut shown in Fig. 4, which functions as an adjustable limit stop, and the spindle travel has been increased to $2\frac{1}{4}$ in., which is $\frac{1}{2}$ in. greater than the standard travel. This was originally done because a particular job for which the machine was to be used involved specially deep drilling, but it is stated that the increased travel has not been found detrimental in any way. The machine is fitted with a Jacobs No. 1A chuck, which will hold drills from $\frac{1}{4}$ in. diameter down to No. 76, and the sensitivity is fine enough to use the smallest drills quite satisfactorily. All bearings are bushed, with the idea of easy replacement should this become necessary, but it is agreed that unbushed bearings would have been satisfactory. After three years of work, there is no detectable wear of the bearings.

(Continued on next page)

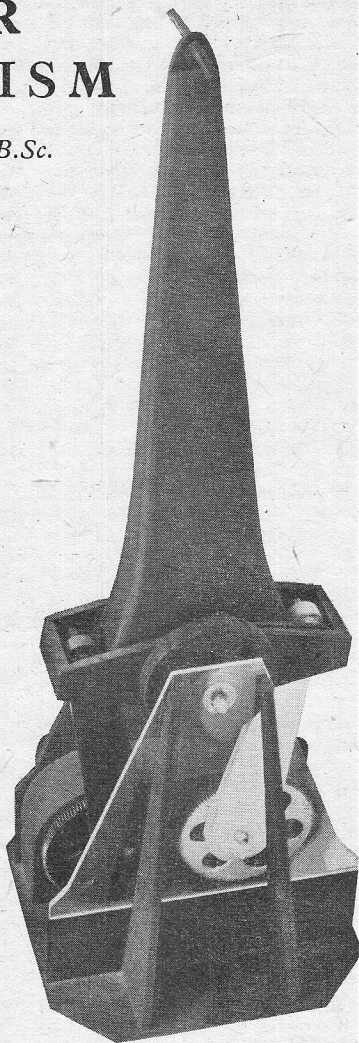
RADAR MECHANISM

By B. T. Turner, B.Sc.

THE model shown in the photograph looks like a hybrid beam engine, but actually represents a quarter-scale model of a radar mechanism. It was made by the writer in his modest workshop, for the purpose of demonstrating the working principle of this mechanism at the lecture given before the Junior Institution of Engineers, on January 18th. Most of the model is made from wood, with the exception of the cheek side-plate of the holding-frame, which was built of perspex to allow vision of the complete driving system.

The phasing gear-wheels were obtained from old scrap off an aeroplane, while the bearings were all made of wood and turned on the writer's 4-in. Drummond round-bed lathe.

This unit's function was to oscillate a centimetric wave-length dipole at 15 c.p.s. in the aperture plane of a 30 ft. paraboloid, the amplitude of this oscillation being 11 in. On the actual



job, the dipole holding-arm was a riveted dural box-type structure of 5 ft. 6 in. length. This was driven by the connecting-rod, indicated in white in the model, from the driving shaft. From this shaft was also driven a balancing system, from the gear-wheels previously mentioned, which consisted of a balancing-frame so designed to move in the opposite direction to the arm and balance out inertia forces at all positions. A full description of the theory of this mechanism was given by the writer in his lecture.

Although the working model could not be run at 15 c.p.s., it could be manually operated at slow speeds by a crank attached to the driving-shaft. It provided an interlude during the lecture after the mathematical treatment had been dealt with, and offered an excellent opportunity for demonstrating the scissor motion produced about the main bearings.

The actual equipment weighed just over one ton and was positioned some 18 ft. 0 in. off the ground on a rotatable tower in the centre of a reflecting parabola. These ground-to-air radar stations were placed round our coasts and gave valuable service throughout the latter stages of the war.

So this new technique has impressed itself upon the model engineer — perhaps some reader can better this and produce a model atomic energy plant?

The "M.E." Sensitive Drilling Machine

(Continued from previous page)

Lubricators of the wick type are also fitted to the countershaft bearings; these are of the cylindrical type and fitted with spring lids.

Jockey Pulley Spindle

In order to enable the spindle to be shifted into position to line up with the pulleys on either of the three speeds, it is made in two parts, one of which screws into the other, as shown in Fig. 5, and the two ends are fitted with large diameter hand knobs, so that no tools are necessary to manipulate them. The rear lug of the headstock casting is slotted, as in the standard design, to provide the required latitude of movement of the

spindle, but instead of countersinking the seatings to locate the spindle in its three working positions, these are counterbored as shown, in order to avoid any tendency to spread or possibly split the lug when the spindle is tightened up.

Mr. Wedge's machine is not only distinguished by its good workmanship and improved detail, but is also very well finished, the castings and belt guard being stove enamelled in grey. The stoving was carried out in the domestic gas oven, with the "Regulo" thermostat set between $\frac{1}{4}$ and $\frac{1}{2}$, and the time taken was between 75 and 90 minutes.

(To be continued)

The Arnside Boathouse

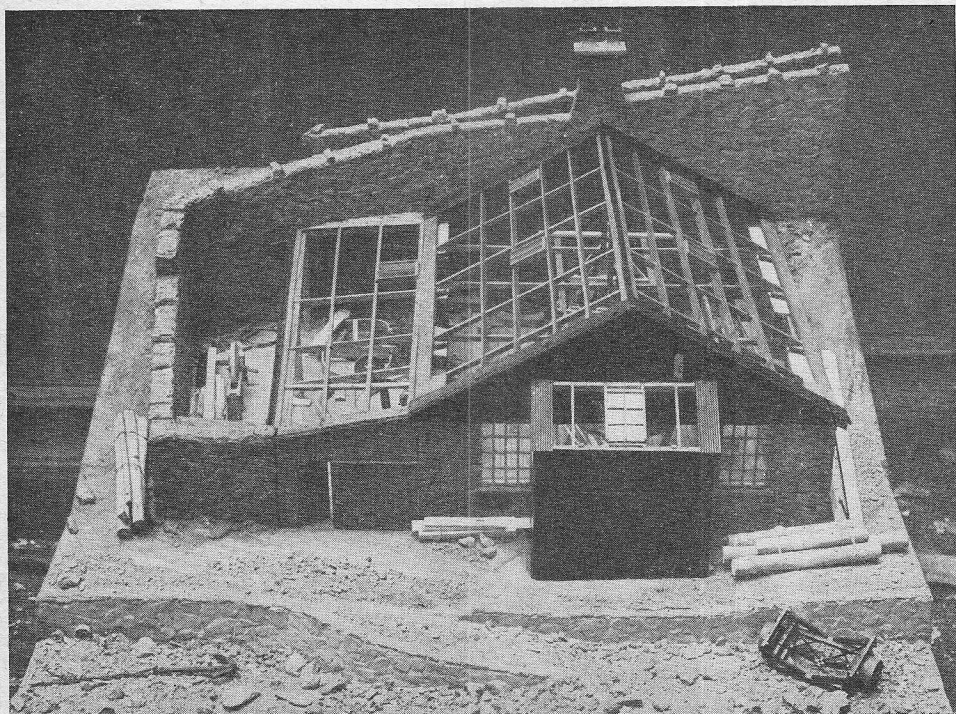
An Unusual Model

By E. Cuthbert Woods, L.D.S., R.C.S.(Eng.), F.R.Hist.Soc.

AT the end of Arnside Promenade stands a building bearing the weathered sign "Wm. Crossfield, Boat Builder." The firm has not always occupied this site, as it began in Church Street, Arnside—curiously enough, at some distance from the river. The present proprietor of the firm of Crossfield Brothers, Fred J. Crossfield, is a grandson of the founder, Francis Crossfield, who started it about 1853. It was moved to the present site in 1893, but the original building has been considerably altered. A news-cutting dated April 8th, 1893, states: "The largest boat ever built at Arnside was launched from the yard of Messrs. Crossfield Brothers, on Tuesday. It is 38 ft. 6 in. overall, 10 ft. 6 in. beam with a draught of 6 ft., and it is intended for cod and prawn fishing." About two-thirds of the fishing smacks now at Morecambe were built by Crossfields, and the firm's fame extended till examples of their skill were to be found as far north as Annan on the Scottish side of the Solway, and all down the coasts of Lancashire, Cheshire, and North Wales as far as Newport. Although they built more smacks than

any other craft, dinghies, motor boats, yachts, and a lifeboat for Morecambe were also turned out. As there is no one to succeed F. J. Crossfield at Arnside, it is more than likely that the firm will not continue after his day, although he has a cousin, a boat-builder at Conway. It thus seemed appropriate to secure a lasting and detailed record of a famous, though small, boat-building yard before it might fall victim to replanning and improvements, and a scale model was projected by Dr. D. A. Allan for the Shipping Gallery in the City of Liverpool Public Museum. For convenience of size, the scale selected was half-an-inch to the foot, giving an exhibit approximately a yard square.

Although the construction of ship models is no new task for me, the building of a boatyard model presented novel features and problems, which may be of general interest. The first difficulty was to obtain accurate measurements, for the site was excavated out of a rough limestone hillside, and the boatshed itself is so packed with tools, material, and all manner of marine equipment, including timber, nets and oars, lining



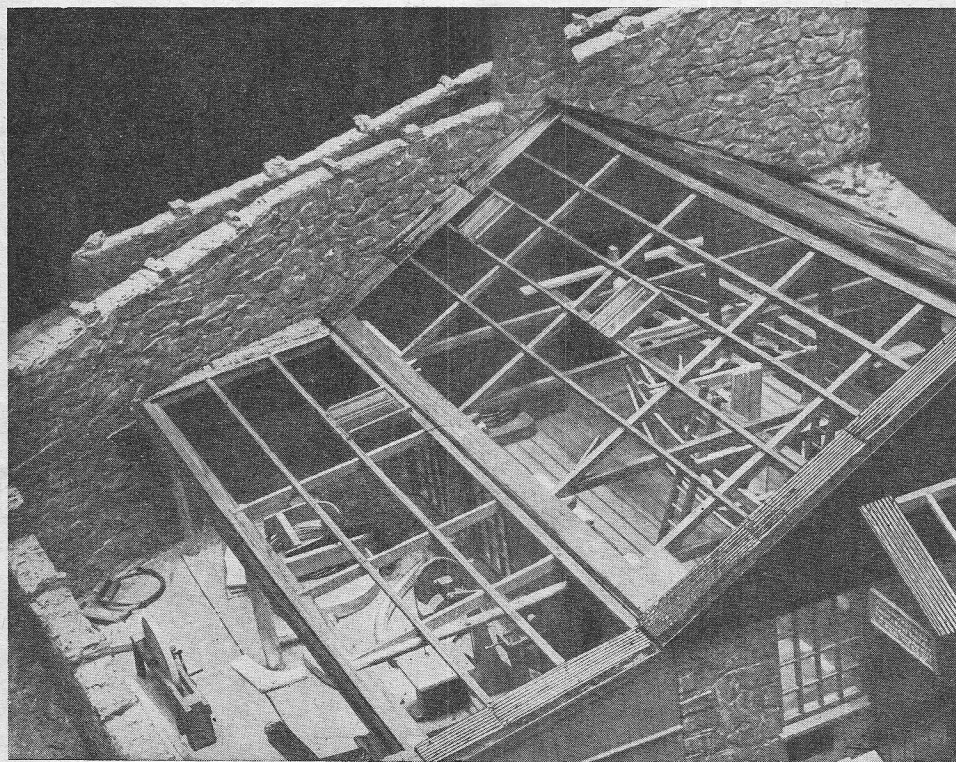
View from the shore, showing front elevation, river wall, slip, and foreshore

the least possible amount of solder, the shorter piece of brass was held in place against the longer. The required number of holes were drilled through. Having cut off the head of the pin, leaving the amount required to bend to a staple shape, it was then seized in a watchmaker's pin vice, point end inside, a point was put on the other end as well, using a file and rotating the pin against the bench peg. The pin is now passed through the strap part of the hinge, which may require clearing from excess solder with a watchmaker's broach or rimer, and is then bent to a staple-shape or a sharp-pointed hairpin filed to a square. The strap hinge is fixed to the battens of the door by small (Lillikin) pins driven through and clenched on the outside. The staple is easily pressed home into the jamb of the door by holding it in a pair of watchmaker's pliers.

The window frames are of pine and the cross bars are of elm. When the frames were rabbetted,

head was cut off one of the pins to be used, the pin was grasped in the pin vice and filed till it had four flat tapering sides and not too fine a point, rather like a broach or rimer. Still held in the vice, it is used as a drill by rotating between the finger and thumb. This slow but sure method produces a hole which is just friction-tight for the rest of the pins, so there is no danger of the wood splitting. As the heads of the pins looked too large in comparison with the sashes, headless pins were used, the protruding point, and excess of the pin cut off and filed flush with the wood crossbars, both on the inside and the outside of the window. It was found more satisfactory to "drive" these pins, by grasping them in a pair of fine-nosed pliers and pressing them into place, than by using a hammer.

Now a word about the tools. The blacksmith's leg-vice is a working model made of brass, the use of steel being prohibited on account of rusting. The spring which pushes the jaws



View of model from north-east, and taken from above to show the yard, and partly-built smack in boathouse

and glued and pinned together, care being taken that they were just a snug fit for the openings left in the masonry, a piece of acrylic resin was cut to the size and glued into the rabbet. On to this were superimposed the crossbars, fitted into one another and the frames, by points into V-notches and glued into place on both sides of the "glass." When the glue was set, holes were drilled through the wood and acrylic resin. The

apart is made from the spring contact cut off a used cycle-lamp dry battery. The other small tools—adze, axes, hatchet, auger, chisels—are made of German silver. The grindstone is of wood, painted with glue and brickdust. The bandsaw and the electric motor to drive it are also of wood. A caulking mallet and "iron" are included among the small tools, but the one with which the public are least likely to be familiar is

the chain. It is made like a bicycle chain, but the links, instead of iron, are made of wood. When the stem and stern post of a smack have been made and fixed to the keel, they are erected in a vertical position, with the several sections fixed in correct place and attached to the keel and the gunwales. A number of temporary scantlings are nailed a few inches apart like planking, from bow to stern and from gunwales to keel. Then the chain comes into use. It is placed in water till the wood swells, and when bent will retain whatever shape it has been bent into. A point is selected on the gunwale about the greatest beam, and the chain, held in a vertical position, is pressed until in contact with all the scantlings from the gunwales to the keel. Its form is then marked on a piece of naturally curved timber, or several pieces joined to the required length. It is taken to the saw bench, sawn out, finished off by the adze, and secured in position to the gunwale above and the keel below. This is repeated on the opposite side of the boat and for each set of ribs, which are usually set about ten inches apart. When all the ribs have been set, the sections and scantlings are removed, and the fitting of the outer gunwale and planking proceeds. Each rib is thus held at the deck end between the outer and the inner gunwale.

The painter's bench is an indispensable part of any boatyard and the paint pots in the model, realistically coloured and stained, are either small dry batteries of various sizes or, in the case of the smallest tins, were specially made by swaging up from thin sheet copper in a Sharpe's crown swager, a dental tool for making seamless bands and gold crowns.

One point of interest is the notch cut in the end of the bench immediately behind the door. It is about three inches broad and two inches deep, and is used to steady the ribs for smacks and boats of that size while they are being trimmed up with the adze. The lower end is held steady by the foot while the adze is used.

The trolley, lying on the foreshore, was required when the boat was ready to launch. She was lifted up, the trolley run underneath, and so sped over the promenade seawall on planks down into the water. Some time ago, the trolley made the trip to Windermere by road, carrying a boat and accomplishing the journey without incident. Now it has once more "drowsed the long tides idle" below the boathouse on Arnside shore, and, when the boathouse has gone, this model may remain to conjure up pictures of a bygone day.

Incendiary: By "Disgruntled"

BEING one of those who occasionally bark on the outside of the model-making crowd, and/or up the wrong tree, perhaps a few kindly thoughts on the commonest source of that divine fire, which started most of our modelling careers, might rouse enthusiasm or ire in some of the various personalities connected with the hobby!

Methylated spirits, as we know it, is ethyl alcohol ($\text{CH}_3\text{CH}_2\text{OH}$) adulterated with either wood or mineral naphtha and coloured with methyl violet (there are various other forms of adulteration), by which admixture a beneficent Government renders it unfit for use in the human carburettor, and as its components all probably have similar boiling points, it is difficult to separate out the alcohol either for legal or illegal purposes by fractional distillation.

The aforementioned added impurities help to give it that well-known odour which may, or may not, be incense to the high priest of the spirit burners (Mr. Harrison), but a pain in the neck to most.

It is a curious thing that whereas the home-produced "Ajax" had its flames far too close to the bottom of the boiler to get really the full benefit, the "Hun," in things like "Vulkan," and a host of stationary toys, rarely, if ever, made this mistake; also, he produced the vaporising spirit lamp with a pilot burner and a true Bunsen type, also with a pilot flame, for heating domestic spirit irons, but exactly why this latter was never developed into a bigger, better and hotter lamp for simple stationary engines and boats, rather defeats me—we adapted one to a small boat boiler nearly 35 years ago.

Most of us have tried, both accidentally and intentionally, firing by the boiling vapour, and I cannot help thinking that the plant described some years back in THE MODEL ENGINEER, which used exhaust steam to heat the container, received scant attention and deserved far greater consideration.

My physics and chemistry are rusty in the extreme, but I always suspect that, volume for volume, there is not the heat in alcohol that occurs in the paraffin group, in spite of its use in motor-racing fuels; and whilst methyl alcohol (the first of the series), is far too volatile, I often wonder if propyl and iso-propyl and those higher alcohols of the series, have any combustible virtues; after all, iso-butane (the fourth of the olefine series) is used every day in cylinders as a domestic heating agent, and whilst being a gas at anything much above freezing point, is of no use for our purposes normally. On this analogy, would it not be possible to utilise some of the higher alcohols? Still, my ignorance of these matters is profound, but one can recall that metaldehyde, as an alternative fuel, has been used in models, as well as for killing slugs and heating curling tongs; hence I merely fly these ideas as a kite! At the same time, I personally wonder if petrol vapour, generated by the aforementioned method of heating the container by the exhaust, and ejected at low pressure from a relatively large nozzle or jet in a Bunsen type burner, is not a possible answer to quite a lot of problems, e.g., surging, carbonisation, choking, and loss of pressure—but I think I have already said far too much, and anybody else can now rush in where angels fear to tread!

Aids to Boilersmithing

By "L.B.S.C."

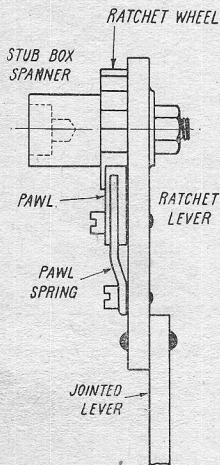
AMONG the cascade of original literature which regularly flows over our doormat every morning, I recently found a communication from a follower of these notes, who was in trouble with the job of staying a firebox; and as his difficulty is one frequently encountered by beginners, a word or two on the solution may not come amiss, in the interval whilst I am getting out some more "Lassie" valve-gear drawings.

The engine is an old-timer; not one which I have described, as it is similar to the Stirling F1 class of the old S.E. & C.R., and in $3\frac{1}{2}$ -in. gauge. The firebox is narrow and deep, going well down between the coupled axles, and our friend has taken the general design of it from the boiler I specified for "Petrolea." His particular trouble is, that the top row of firebox stays come right in the part where the top of the firebox bulges out in line with the wrapper; he says, first of all he had a job to get the tap to go through both the holes in wrapper and firebox, about half the holes in the wrapper having distorted threads. This was due to the tap not "shooting straight" at the inner hole when tapping the outer one. Then, when inserting the stays, it took him about half an hour to get four nuts on. How on earth he is going to tighten them up, he says he doesn't know; even if a bent spanner would reach them the length of the box will not allow sufficient swing on the tail end of the spanner to pick up the next pair of flats on the nut, and if the spanner is reversed, the bend is naturally reversed also, and won't go near the nut! So what?

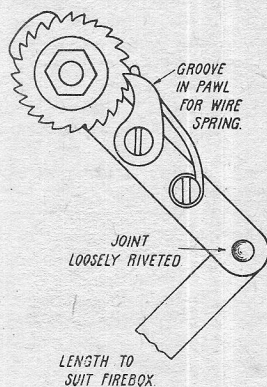
Easily-made Staybolt Tap

I have described this tap before, but it was some time ago, and beginners will probably be unable to get the back number, so here is a brief résumé. As the stays in question are 5-B.A., get a piece of $\frac{1}{8}$ -in. silver-steel about 3 in. long. Chuck in three-jaw with about $\frac{1}{8}$ in. projecting, and turn it down carefully to a full $\frac{3}{32}$ in. diameter, so that it will just go nicely into a No. 40 drill-hole. Pull the steel out of the chuck a little more, and put $\frac{3}{8}$ -in. length of thread on it with a 5-B.A. die in the tailstock holder, using plenty of cutting oil, and pulling the belt slowly by hand. Reverse in chuck, and file a square on

the other end. Now either mill three grooves in the threads, or file four flats; a ball-headed dental burr in the three-jaw would do the needful in the milling line quite well, the tap blank being clamped under the tool-holder. It doesn't matter a Continental about the grooves not being spaced exactly the same distance apart. Heat the screwed part and the pin to cherry-red, and plunge into cold water. Brighten the flutes or flats with a bit of emery-cloth (beginners bend it double, and apply the bent edge to the flutes), then hold it on a bit of sheet iron over a gas or spirit flame until the flutes or flats turn brown, and pop it quickly into the water. The temper of the pilot-pin must be drawn, or it will break off, so hold it against a piece of red-hot iron—kitchen poker will do—until it has properly "got the blues." It need not be quenched. To use, anoint the tap with cutting-oil, poke the pilot-pin through both holes, and proceed in the usual manner; the pilot-pin in the second hole keeps the tap in line with same whilst first hole is being tapped. If a squared tap has been made, put an ordinary tap through afterwards, as a squared tap won't form a perfect thread in copper, although the thread it *does* form will be a guide for the finishing tap, and the final threads in the copper should be perfect.



Small ratchet box-spanner

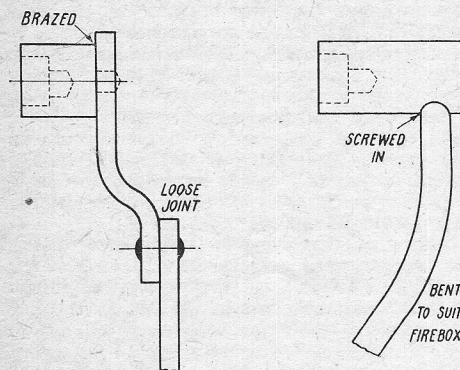


How to Make a Ratchet Box-spanner

The trouble of tightening up stay-nuts inside the fire-box can easily be overcome by means of a small ratchet box-spanner with a jointed handle. This gadget will reach and tighten a nut in the most remote and otherwise inaccessible corner, where there isn't room to manipulate an ordinary spanner; and it takes very little time to make. For 5-B.A. nuts, chuck a piece of $\frac{3}{8}$ -in. round mild-steel in

the three-jaw; face the end, centre, and drill down about $\frac{1}{16}$ in. with $\frac{9}{64}$ -in. or No. 28 drill. Open out to a full $\frac{1}{8}$ in. depth with $\frac{1}{8}$ -in. drill; then turn down $\frac{3}{8}$ -in. length to $\frac{3}{8}$ in. diameter. Remove from chuck, and drive a 5-B.A. steel nut into the counterbore, or better still, a piece of hexagon steel rod the same size; then hammer down the outside until it closes on the nut and forms a hexagon-shaped hole into which the nut can easily be slipped or removed. **Re-**

the vice ; and to prevent it slipping down, take out the two hard-metal jaws which are found on most bench vices—usually fixed with countersunk screws—and put the piece of bar in the steps where the jaws rested. Slip the firebox over the bar, so that the inner end of the stay on which you wish to commit assault and battery rests on



Two useful stay-nut spanners

the excrescence; you can then go ahead and rivet over the outer end without fear of anything slipping. Stay-nuts should always be given a final tighten-up after performing on the heads, as the hammering usually loosens them.

“Hielan’ Lassie”

Inside Valve-gear (contd.)

No detailed instructions will be necessary for making up the strap and rod for the inside eccentric, as the process is exactly the same as described for the eccentric-strap and rod for the feed pump. The only thing is, that the strap is a fairly large one, the bore being $1\frac{1}{8}$ in., and therefore easily distorted ; so be careful when drilling the oil-hole and slotting the lug for the rod. The eye at the end of the rod should be casehardened as per directions already given. The nominal distance between the centre of the strap and the centre of the eye should be 3 in., and will be correct if all the rest of the gear has been made exactly to the given dimensions ; but everybody is liable to make a little slip somewhere or other, and very often this can easily be counteracted with the minimum of trouble, and no deleterious effect on the working of the engine. Therefore, in the present instance, don’t rivet and solder the rod into the groove in the lug of the eccentric strap right away, but make it a tight fit, and secure it temporarily by a small setscrew in one of the rivet holes ; then, if any adjustment should be necessary, in the length of the rod, it can be made right away, the strap and rod taken out complete, and permanently connected before replacing.

Incidentally, talking about making slips and wrong connections, a reader recently wrote and said his “Molly” went backwards with the lever in forward gear, and *vice versa*, and he couldn’t understand what was the matter with it, as he

had followed the instructions very carefully. All that was amiss, was that he had reversed the eccentric-rod forks, and connected the forward gear eccentrics to the bottom of the links instead of the top, so that the lever had to be pulled back to bring the forward gear eccentric rods into contact with the die-blocks. The mistake is very easily made ; many years ago, a new fitter at West Croydon shed on the L.B. & S.C. Railway did some repairs to the motion of one of the goods tanks, and made the same mistake when re-erecting. It was not noticed until the driver pulled the lever back to come out of the shed, and when he opened the regulator, the engine promptly went ahead and knocked a big gap in the end wall.

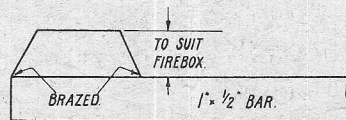
Reverse-shaft Bearings

The reverse-shaft works in two bearings screwed to the inside of the frames, and does not pass through holes in the frames themselves. The bearings are of the oval flanged type; castings may be available, but if not, round rod can be used. Any metal will do, as the wear is infinitesimal. Chuck a piece of 1-in. rod in the three-jaw ; face, centre, and drill down $\frac{1}{16}$ in. or so with $\frac{1}{4}$ -in. drill. Turn down $\frac{1}{8}$ in. of the outside to about $\frac{3}{8}$ in. diameter, and part off $\frac{1}{4}$ in. from the end. The circular flange can be filed oval, for sake of appearance, or may be left round if desired.

The reverse-shaft is located $1\frac{1}{8}$ in. ahead of the crank axle, and $1\frac{1}{8}$ in. from the top of the frames. Mark off these distances on the frames at both sides, and centre-pop the places where the lines cross ; then, at $\frac{3}{8}$ in. each side of the centre-pop, drill a No. 30 hole and countersink it. Put the reverse-shaft temporarily in place, with a bearing on each end of it, and carefully adjust for correct position ; then temporarily clamp the bearings to the frames, with a toolmaker’s cramp over flange and frame. Run the No. 30 drill through holes in frame, making countersinks on the flanges, follow with No. 40, and tap $\frac{1}{8}$ -in. or 5-B.A. to take countersunk screws when the gear is erected “for keeps.”

How to Assemble the Gear

With the given arrangement of valve-gear, the whole bag of tricks can be assembled clear of the engine, then dropped into place and easily coupled up. Take out the motion-plate and the reverse-shaft. If you have not already done it, put the radius-rod through the link until the die-block pinhole is in the centre of the link slots, either above or below the trunnions ; then put a die-



“Holder-up” for heading stay-bolts

block each side, and a $\frac{1}{8}$ -in. silver-steel pin through the lot, riveting the pin over each side just sufficiently to prevent the die-blocks coming off. File the ends smooth. Put the lifting die-block in its slot in the radius-rod, and place the block between the two lifting arms on the reverse-shaft, squeezing a $\frac{1}{8}$ -in. silver-steel pin through

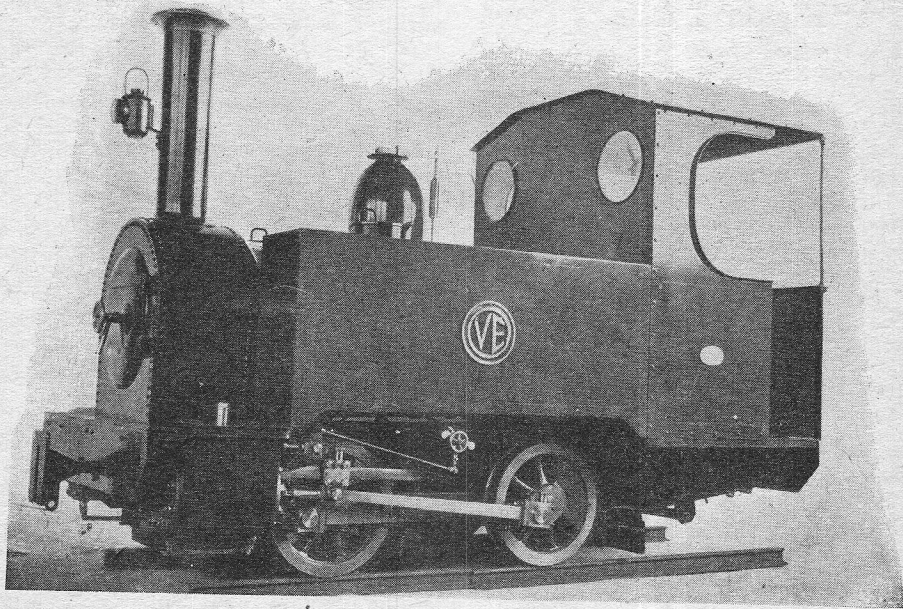
the lot, and filing flush each side. Put the other end of the radius-rod through the slot in the motion-plate, put the link-trunnion in the bush in the bracket, and attach the loose bracket. The radius-rod eye is now placed in the slot in the top of the combination-lever, and a $\frac{1}{8}$ -in. pin squeezed through the lot, filing flush each side, as before. Now drop the complete outfit in position; attach motion-plate and reverse-shaft bearings, couple up the top of the combination-lever to the valve-fork or crosshead, and the union-link to the arm on the main crosshead. I have already described how to make little bolts of silver-steel for this purpose. Put on the eccentric-rod and strap, and connect up the eye to the link tail by the little bolt illustrated in the detail drawing of the link; and that will complete the erection. To set the valve, take off the steam-chest cover; set the gear in mid-position, so that when the wheels are turned, the radius-rod does not move. The combination-lever should just move the valve enough to show a thin black line of port opening, at each end of the valve movement; that is, when the crank is on dead centres. If one opens and the other doesn't, adjust the valve on the spindle

by turning the fork; if neither opens, the valve is too long and needs a shade filing off the laps. Be careful to file an equal amount off both; don't take it all off one side, or you'll hear syncopated beats.

If the port-openings in full gear are unequal, the eccentric-rod is either too long or too short; if you have left the rod as recommended above, the adjustment can easily be made by trial and error, and the rod can be permanently attached to the strap after the right position has been found. When I say "unequal," I mean so bad that they are distinctly visible to the naked eye; actually, the best set of Walschaerts gear in the whole wide world will not give *exactly* equal openings in both gears at both ends of the cylinder. For beginners' benefit I might repeat that the *only* valve-gear which gives a perfect setting is the much-despised loose eccentric.

Talking about valve-gears, will those readers who have written me about the valve-gear of the Southern "Pacifics," please note that the gear is illustrated and described in the March issue of the *Locomotive Magazine*. All being well, I shall have something to say about it later.

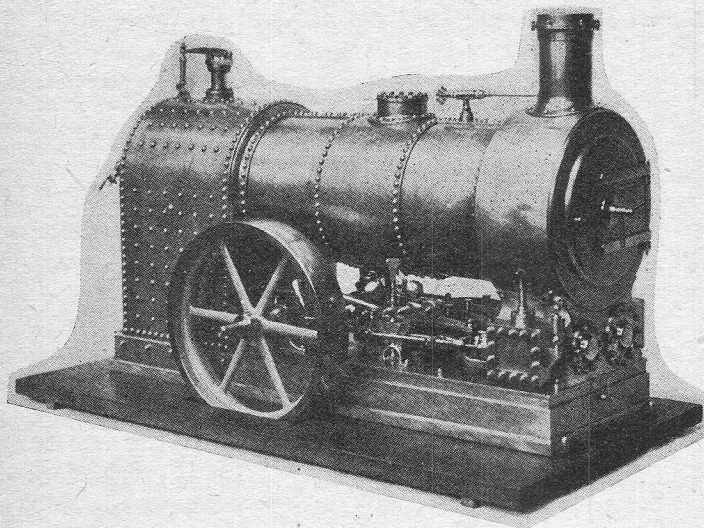
A 9½-in. Gauge Miniature Locomotive



The miniature "Peckett" tank locomotive illustrated above was built by the Rev. H. T. Brown, of Ballygally, Co. Antrim, for a friend. He did all the work on it single-handed, and it took him fifteen months of his spare time. The boiler is all copper, sifbronzed. As the prototype runs on 3-ft. gauge, the miniature is roughly a quarter full size. She ran her first steam trial on "VE" day, hence, the side plates!

FORTY YEARS AFTER

By Frank Baines



admired, and was also found very instructive, owing to the fact that the reversing gear could be worked by means of a knob on the outside of the case in which it was exhibited.

I was surprised to find that I could do this work as well as ever, (although not as quickly), owing to good eyesight, and the fact that I had kept chiefly to light engineering work.

I then decided to build a more ambitious (if not final) model; this I have now completed, and the photographs herewith show the result.

This is a 2-in. scale model of an undertype compound steam engine, fitted with expansion valve governing gear driven by flat belt and bevel gear.

Cylinders are of $1\frac{1}{4}$ in. and $1\frac{1}{8}$ in. bore, by $2\frac{1}{4}$ in. stroke. The crankshaft is of the round bent design,

but had to be cut out of flat bar steel in order to get the corners full.

The boiler is built of $\frac{1}{16}$ in. mild-steel plate and contains copper firebox with 46, $\frac{1}{8}$ in. diameter copper tubes; also, tubular superheater in smokebox.

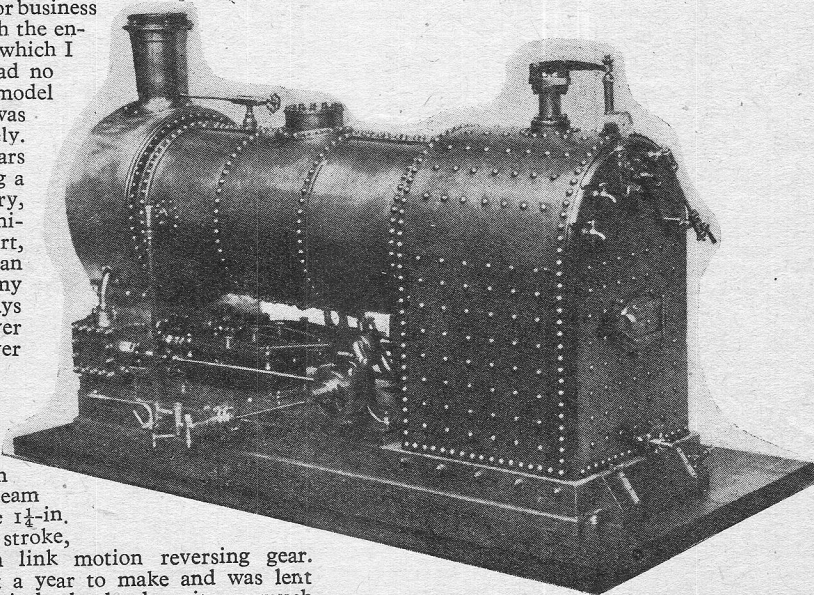
There are 560 rivets in the boiler shell and 218 screwed and riveted copper stays in the firebox.

IN THE MODEL ENGINEER, dated March 9th, 1905, there were published a set of photographs of a model $1\frac{1}{2}$ in. scale G.N.R. locomotive, which I had then just completed, and which, a few months later, was acquired by the Board of Education as a permanent exhibit in the Science Museum, at South Kensington.

As I was then commencing to build up a motor business in connection with the engineering firm in which I was partner, I had no time for more model work and it was shelved indefinitely.

About three years ago, I was feeling a little war weary, working on munitions and transport, etc., and I began to realise that my useful working days were getting over (being then over seventy years of age).

I then thought I would try my hand at my old hobby, and I began building a twin steam horizontal engine $1\frac{1}{4}$ in. bore, by $2\frac{1}{8}$ in. stroke, with Stephenson link motion reversing gear. This took about a year to make and was lent to the local technical school, where it was much



*Railway Interlocking Frames

By O. S. NOCK, B.Sc., M.I.Mech.E., M.I.R.S.E.

No. 5. The McKenzie and Holland "Cam and Rocker" type—Part I

THE firm of McKenzie and Holland, in adhering to the principle of lever, as opposed to catch-handle locking, adopted an indirect system of actuating the locking in order to avoid the long stroke resulting from a direct drive, as in the Stevens apparatus. Also, with the latter firm's patent for tappet locking in operation, some other means of effecting the interlocking between levers had to be employed. In view of the outstanding simplicity of the Stevens frame, it is certainly a tribute to the design and workmanship put into the two considerably more complicated rivals—the Saxby "rocker and grid" and the McKenzie "cam and rocker"—that both these frames achieved a high international reputation, and enjoyed a long lease of life. Fig. 1 shows a cross-sectional arrangement of the McKenzie "cam-and-rocker" type apparatus.

The main framework is built up on similar lines to that of the Stevens. Two rolled-steel

angles 3 in. \times 2 in. \times $\frac{1}{8}$ in., one at the front and one at the back, run the entire length of the frame; these are supported at intervals by the standards shown in Fig. 2, and the angles carrying the floor-plates are also shown in Fig. 2. The joint between adjacent floor-plates occurs on the centre-line of the lever, and it will be seen that like the Saxby rocker frame, and unlike the Stevens, there is a raised rib on both sides of the lever on which the lever-catch slides. In the McKenzie frame now under consideration the catch is spring-loaded, as shown in Fig. 3, as opposed to the heavy cast-iron drop-box used on the Stevens frame, with which reliance is placed on gravity alone for keeping the lever securely latched in one or other extreme position. The lever itself is a single forging, continuous from the handle to the tail, containing the holes for the signal and point operating connections. It is mounted by means of a separate shoe, illustrated in Fig. 4. These shoes are of malleable cast-iron

*Continued from page 398, "M.E.," April 18, 1946.

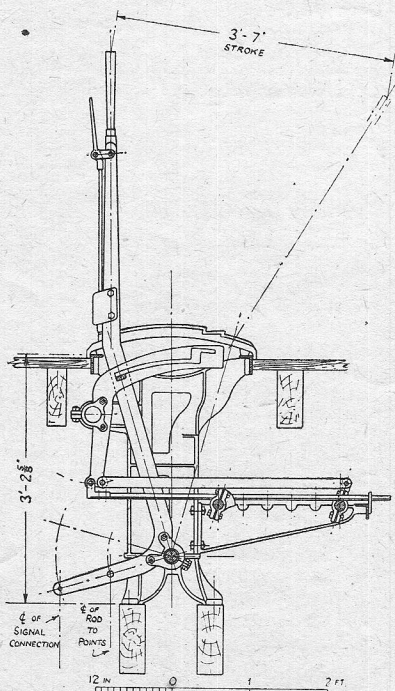


Fig. 1

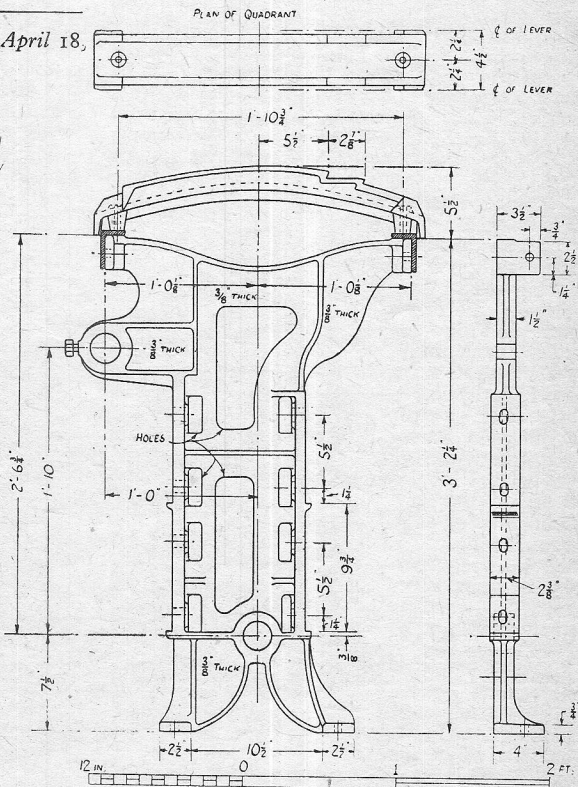


Fig. 2

and are made in two halves clamped together so as to facilitate the easy removal of a lever from the frame. The levers with their shoes are pivoted on a shaft that is continuous throughout the frame (though, of course, such would have to be made in two or more pieces in the case of very long

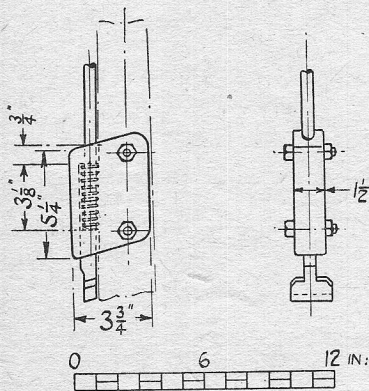


Fig. 3

frames); the lever shoes are located on the shaft in special notches, the shaft itself being $2\frac{1}{4}$ in. diameter turned down to 2 in. for lengths of $2\frac{1}{2}$ in. to accommodate the lever shoes. Why this expensive turning was adopted, instead of the use of a plain shaft 2 in. diameter with distance collars between the lever shoes, strikes one today as something of a mystery.

Now we come to the cam movement through which the locking is operated. On the lever is bolted a rectangular stud, as shown in Fig. 4; this slides in the slot of the cam illustrated in Fig. 5. Normally, the stud rests in the notch A,

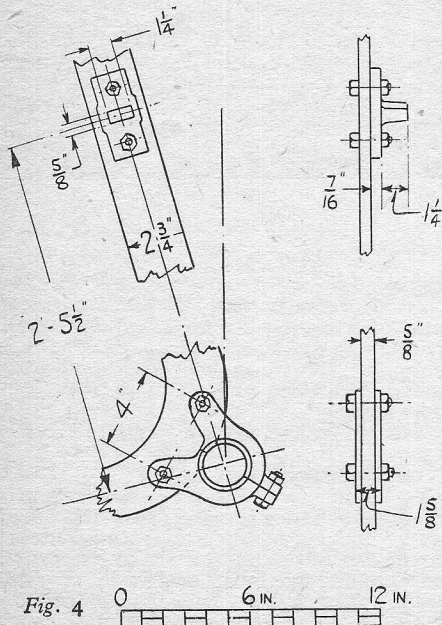


Fig. 4

and the position of this notch in relation to the cam pivot B should be carefully noted. When the signaller attempts to pull the lever the stud presses against the surface marked C; due to the oblique position of the cam pivot B, the reaction between the stud and surface C tends to turn the cam in a clockwise direction and after a movement of about $1\frac{1}{2}$ in. at the tip of the lever handle the stud is free to travel along the curved slot. With the cam in this position the slot is radial to the lever pivot, and no further movement takes place until the stud reaches the stepped portion of the cam-slot, when a further rotation of the cam—effected in a similar way to that occurring at the beginning of the stroke—is made. Thus it will be seen that at the tail of the cam, from which point the locking is operated, there

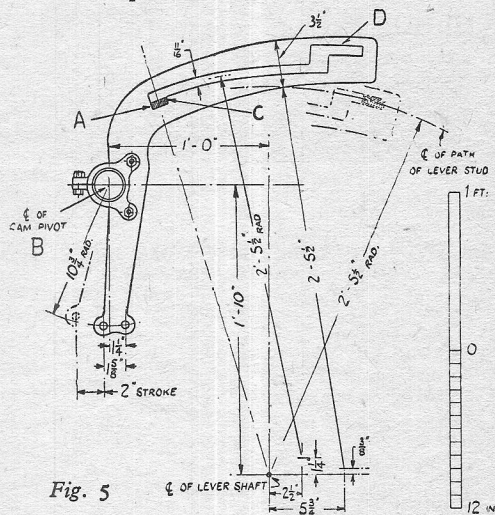
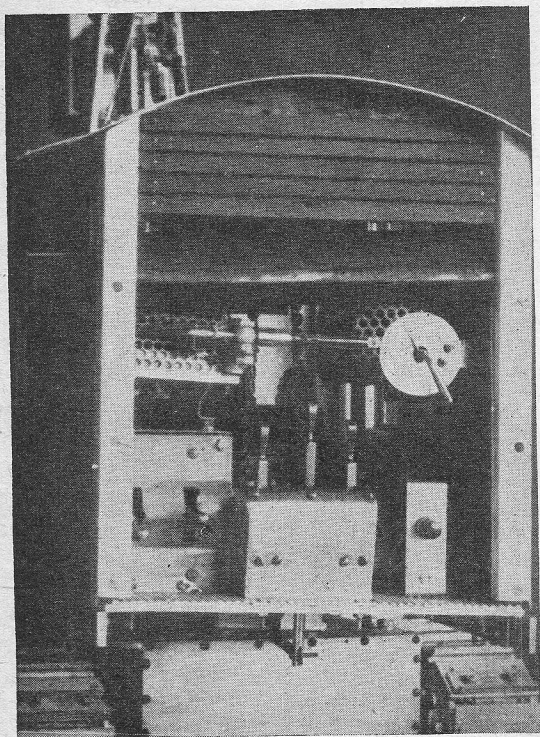


Fig. 5

is a stroke of 1 in. during the first movement of the lever, and a further 1 in. at the end of the stroke. This, to some extent, repeats the action of the Saxby rocker motion, though in the latter frame, of course, all movement of the locking grids takes place entirely before and after the stroke of the lever. The cam is mounted on a shoe similar to that of the lever itself, the camshaft being $2\frac{1}{4}$ in. diameter turned down to 2 in. for lengths of $1\frac{1}{2}$ in. to suit the width of the cam shoes. The centre-line of the cam is $1\frac{1}{4}$ in. on one or other side of the lever centre-line, and notches are cut in the camshaft to enable the cams to be mounted on whichever side is most convenient for the interlocking. Beyond the vertical part of the cam-slot that completes the stroke of the locking in the reverse position of the lever, there is an extension of the cam-slot, D; this provides for an extra long pull in operating functions that may require it, such as distant signals. In Figs. 1 and 2 it will be seen that there are two notches in the quadrant-plate on the reverse side. The first of these is the one ordinarily used, and the outer is used for these exceptional cases. On some variations of this frame no less than three notches were used on some levers.

(To be continued)



Rear view, showing controls

lever. This has proved efficient and smooth in operation, and I pride myself having got something there, apart from a few headaches.

The tracks are each powered by a small motor, suitably geared to the drive shafts, and power for these is fed by slip rings and brushes attached to a hollow shaft which clamps the cab to the chassis, the cab revolving on a 3-in. diameter thrust race. The motor leads are taken through the hollow shaft and connected to a small distribution board in the cab.

External Features

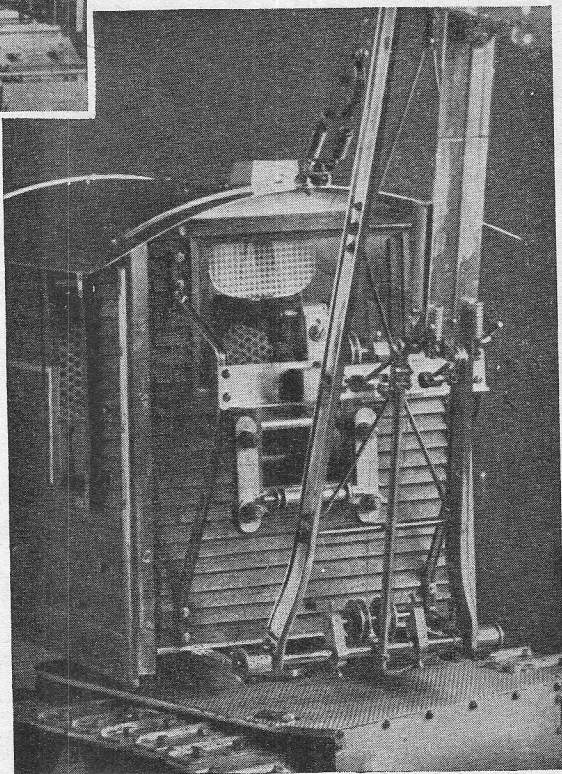
A word about the shovel and other external features. The shovel has a self-returning base, controlled from the cab, and is fitted with twin cables to the winding drum. The idling track drum-bearings are fitted with spring-loaded sliding journals and these have proved very efficient. Sliding windows have been fitted as well as the partly-finished roller blind at the rear to exclude dust. The cutting angle for the shovel can be adjusted quickly

by means of three nuts situated at the cab end of the shovel ramp.

The electrical characteristics are as follow: Voltage, 12 d.c.; current total, no load, $4\frac{1}{2}$ amps., including internal lighting. The mechanical characteristics have not been actually measured, but the track tractive effort, jib lift, and shovel thrust are all of a very high order.

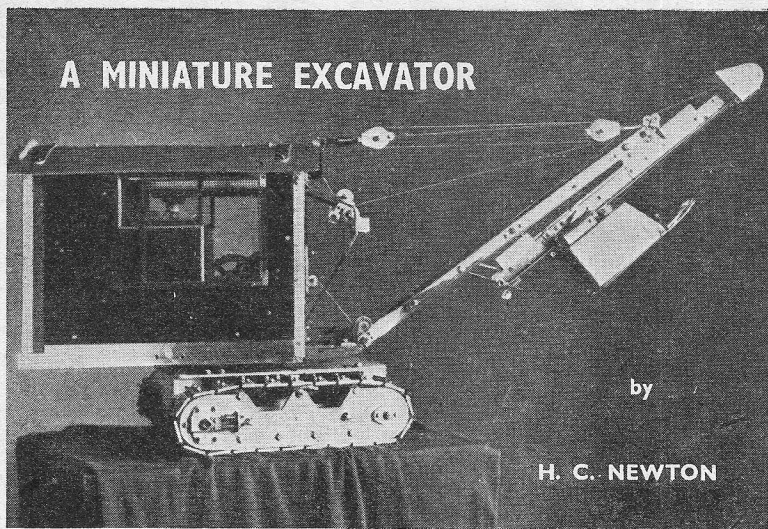
Ready-made Parts

Bought and ready-made parts include gears, motors, springs and ball-races, the rest having been made to blend into what I hope will appeal to readers of THE MODEL ENGINEER as a workmanlike and harmonious whole. The model is easily convertible into a crane, as the bull-nose houses a third central pulley, and I am now adding to my shoal of diagrams and drawings by designing alternative fittings for digging.



Front end details

A MINIATURE EXCAVATOR



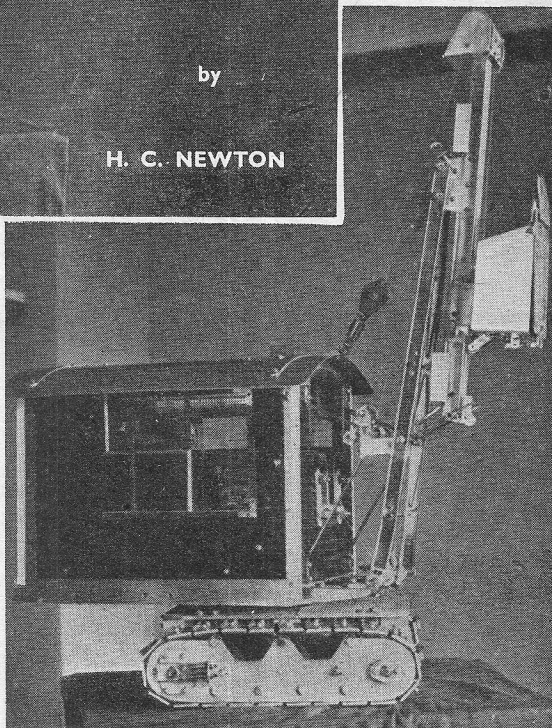
by

H. C. NEWTON

THE accompanying photographs are, I think, an answer to a contributor to *THE MODEL ENGINEER* who asked: "Are we getting into a groove?" with regard to standard and stereotype models, etc. Many moons ago, I set myself the task of trying to produce a working model out of the ordinary, and, furthermore, it must be track-driven; the latter stipulation coming from my elder son.

Foolproof Controls

In due course, I found myself half regretting having started on such a project, for, in addition to other major snags, all controls had to be of a simple and almost foolproof type, my young family as a whole demanding that. In addition, I have no machine tools, plans or prototype details at my disposal and I cannot claim, therefore, that the model is to scale, but rather that it was "evolved" as a workable plaything. Possessing, however, an oversize junk-box and several very small motors, I set to work. I think the photographs will serve to illustrate adequately the external construction, and so a brief description of the various motions and controls may interest readers. The rear view shows the control layout, and, as will be seen, the dust-proof spring roller-blind had not been completed when the photograph was taken. In the centre are three levers each working through a three-position gate with up, neutral and down facilities. In order, left to right of the photograph, the levers control shovel, traverse motion and jib. On the right and halfway up the cab-side, is fitted the speed control and housing (at rear) for resistance element. Underneath this control is the re-start button, of which more later. On the left of the three main control levers is fitted a box containing two



eight-way switches controlling left and right tracks respectively. Each of these switches will cut out or reverse its associated motor, thus giving ample flexibility to track control. Finally, above this switch-box will be seen the track steering and speed control. This works in an horizontal plane and through an arc of roughly 25 deg. and is fitted with a "dead-man's handle."

External Arrangements

To continue with the external arrangements, the shovel and jib motions are fitted with up and down trip switches, two of which can be seen as rectangular boxes on the shovel ramp. On reversing the appropriate movement, re-starting is effected by means of the button mentioned earlier. A further word about the track steering

Letters

Mr. Hambleton's Drawings

DEAR SIR,—One of THE MODEL ENGINEER features I enjoy most is Mr. Hambleton's series of drawings. On page 439 of your issue for May 2nd, is a beautiful outline drawing of one of the old L.N.W.R. "Precedents."

I hope Mr. Hambleton will not think I am carping if I point out a minor error, which might possibly mislead the uninitiated. The rod descending diagonally between the driving and coupled wheels, to operate the front damper is shown passing *outside* the driving wheel, with the spindle or hinge-pin of the damper passing between two of its spokes; it should, of course, be *behind* the wheel.

I have recently had occasion to go into the question of the details and dimensions of paddle steamers, and I have found more of value in Mr. Hambleton's excellent series on this subject than anywhere else under one head. In passing, there is a lot of very useful information on this same subject, dimensions, data, drawings and photographs, in the *Journal of the Institution of Mechanical Engineers*, Vol. 147 No. 4, September, 1942, in which Major Gregson's most excellent paper on "The Propelling Machinery of Cross-Channel Packets," is printed.

Yours faithfully,

Harrow.

K. N. HARRIS.

Rotary Engines

DEAR SIR,—I was very interested in an article which I read in the March 21st issue of THE MODEL ENGINEER, concerning the rotary engine invented by George Henderson in 1864 and I was wondering if it was ever put to practical use.

One thing struck me as being rather unnecessary and that was the large diameter of the flywheel. In the engines such as the normal reciprocating type, this is essential to give the smoothness and power reserve. In the engine in question, considering the diameter of the rotors with that of the flywheel, it seems to me that a lot of power would be wasted in just turning the flywheel, let alone any load being added.

I have often thought about trying this idea out before, but a flywheel would not have been incorporated in the design. I wonder if any of your readers know of any models of this idea.

I have been a reader of THE MODEL ENGINEER for a few years now and I don't know of any other book that interests me quite as much.

Being in the Forces and away from home, one feels rather helpless with a few designs in mind, or on paper, and a workshop some hundreds of miles away.

You can imagine how I look forward to receiving my copy every week (weather permitting).

I am stationed on Lake Garda, Northern Italy, and there are two or three lake steamers; two which pass here regularly are of the screw-type, and one an old, but nevertheless a quite graceful-looking paddler, and no doubt the subject for a model, should any of the Italians round here be "model-minded."

An officer came to me a short while ago and asked me if I could find him some tinplate, as he

was contemplating making a ship model. I don't think I should be far wrong in saying that the old steamer has caught somebody's eye, anyway!

We are making a trip round the lake on a steamer tomorrow, so I suppose I shall spend most of my time watching the engine working. (No doubt a product of "Milano"; that's where nearly all of Italy's machinery is manufactured.)

Well, I will leave you in the knowledge that there must be hundreds of servicemen like myself who look forward eagerly to THE MODEL ENGINEER and really appreciate the contents.

There must have been some very good battle cries during our long history, but I think this is the best:

"Long live THE MODEL ENGINEER!"

Yours faithfully,

C.M.F.

K. HAMER.

Fabricated Crankshafts

DEAR SIR,—I have been reading the article in THE MODEL ENGINEER for April 18th, particularly with reference to welded crankshafts. I agree with your contributor entirely in regard to acetylene welding, which we have never found satisfactory.

With regard to electrical welding, however, Mr. Westbury very much understates the case. We introduced electrically welded crankshafts in our commercial range of engines in 1926 and they have been used in all our commercial productions since that date. As you will appreciate, this covers an enormous number of shafts.

The normal method of construction is to use a drop-forged disc with a short stub-shaft to which is welded a length of suitable steel forming the shaft itself. We have also used this method in a large number of model crankshafts and for other model components, and the whole process has therefore been very adequately tested in service. Provided that suitable materials are used and the work is carried out by experts, the result is entirely satisfactory and quite equal to the use of solid shafts.

Yours faithfully,

A. F. PLINT,

Henley-on-Thames.

Stuart Turner Ltd.

The Robinson Hot-air Engine

DEAR SIR,—It was with great interest that I read the article "First-hand Experience of a Second-hand Engine" in THE MODEL ENGINEER for May 16th, as I am the proud possessor of one of these engines in a pretty good condition.

These engines were used extensively by the Post Office at the beginning of this century for running the bell magneto-generators at small country telephone exchanges which did not have an electricity supply. I made their acquaintance in 1911, when I entered the Testing Branch of the Post Office Engineering Department, as we occasionally had a batch of these little engines in for test after undergoing overhaul in the factory at Mount Pleasant. They ran all day with no attention and with very little noise.

I can relate a rather funny story about these engines. We had a very clever, but misguided genius, who was always trying out new ideas. Well, he conceived the idea of putting some petroleum jelly as a lubricant in the cylinder

Clubs

Kodak Society of Experimental Engineers and Craftsmen

On Saturday, May 11th last, a party of approximately twenty members visited the L.M.S. locomotive depot at Willesden.

The party were first shown over the mechanical coaling plant, the hopper of which contains well over 200 tons of coal.

Next, we went into the round-house, which will accommodate approximately twenty-four engines, and where the turntable is situated. This is of the vacuum-operated type, the motor being a small twin-cylinder oscillating engine. We witnessed locomotives being turned round by their own power, the method being to connect the vacuum brake hose to a similar fitting on the turntable.

From the round-house, we went into the "old" shed, where a few engines were partly dismantled for inspection of cylinders and valve-gear, etc. In the adjoining workshop we were shown the weighing machine, which can register individual weights carried by each axle of any engine.

Hon. Secretary: C. R. L. COLES, Kodak Hall, Wealdstone, Middlesex.

The Society of Model and Experimental Engineers

There will be a rummage sale at the Workshop on Saturday, June 22nd. The sale will commence at 2.30 p.m. As this is a private sale, only members and affiliated members will be permitted to bid.

The last meeting before the summer recess will be held at 39, Victoria Street, Westminster, S.W.1, on Saturday, July 13th, at 2.30 p.m. The talk on this occasion will be given by Mr. Edgar T. Westbury, who will discuss various types of rotary valves applied to internal combustion engines.

Full particulars of the Society may be obtained from the Secretary: J. J. PACEY, 69, Chandos Avenue, Whetstone, N.20.

Leicester Society of Model Engineers

The next meeting will be held on Tuesday, June 25th, at 7 p.m., in the Canteen at the Precision Engineering Works, Wellington Street, Leicester.

A track meeting is to be held on a Saturday afternoon, the date of which will be announced at the above meeting.

Hon. Secretary: J. WALKER, 78, Waltham Avenue, Leicester.

Romford Model Engineering Club

Meetings are held at 8 p.m. on the first and the third Thursdays of each month, at the Red Triangle Club (The Masonic Hall), Western Road, near Romford Station. On June 20th, a talk for the special interest of beginners will be given by Mr. S. W. Carr (member), when anyone who has model engineering problems, elementary or otherwise, is invited to seek enlightenment. On July 4th, a competition night will be held, with the customary informality

which has produced the friendly atmosphere which has become an accepted part of the club's proceedings. Further information can be obtained from the Hon. Secretary: FRANK E. MARKHAM, 38, Kent Drive, Hornchurch. Telephone: Hornchurch 3756.

The Sheffield and District Society of Model and Experimental Engineers

We recently held a very successful exhibition which was opened by the Lord Mayor of Sheffield, the judging being in the hands of Mr. E. T. Westbury. This now makes possible the completion of our continuous track, which we hope to have ready for opening by August 1st. Will members please make every effort to attend at Frecheville every Thursday, except the first of the month? This will be a business meeting at the W.E.A. House, Western Bank.

Secretary: A. F. CLAYTON, 76, Trafalgar Street, Sheffield, 1. Phone 25866.

Altrincham Model Power Boat Club

The next indoor meeting will be held at 14, Elizabeth Street, Sale, on Friday, June 21st, commencing at 8 p.m., and the next lakeside meeting will be held at Lindow Common, Wilmslow, on Sunday, July 7th, commencing at 2.30 p.m.

Hon. Secretary: O. B. BATES, 14, Elizabeth Street, Sale.

Sale Model and Engineering Club

On Monday, May 27th, the club was favoured with a visit by Mr. W. H. Whittaker from the Manchester Model Railway Society, who gave a talk on "OO" gauge railways.

Mr. Whittaker described his extensive layout and detailed the snags and pitfalls into which the unwary fall. His novel speed controller was greatly admired, it being capable of reproducing scale speeds of 80 m.p.h. down to 4 m.p.h.—a difficult feat at the lower end of the scale.

Mr. Whittaker brought along one of his engines—a 4-6-2—a fine piece of engineering.

Cheltenham Society of Model Engineers

The above society are holding a small exhibition in the Town Hall, Cheltenham, on Wednesday and Thursday, June 26th and 27th, in connection with the local flower show.

We do not propose making a very big effort but merely something to call the attention of local modellers to the effect that the Society is still in existence.

Hon. Secretary: J. S. BURGESS, 3, Milton Road, St. Mark's, Cheltenham.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects, which should be addressed to him at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall and Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.

1/2" Scale "Annie Bodie" Chassis to "Words and Music," almost finished, nice job, with cylinder castings, boiler material, safety valves, etc.; also good selection pre-war 1/2" scale locomotive parts and castings, mostly Bonds, £10 the lot. S.A.E. list.—COURT, 158, Craven Road, Newbury.

Amateur Collector Requires engineer made Model Stationary Engine, Locomotive or any interesting model. Minor repairs not objected to. Full details and price please.—BM/UPS, London, W.C.1.

Wanted, Set Wheel Castings and Axle-box Castings for "Midge" Locomotive.—SMITH, 31, Rothersthorpe Rd., Northampton.

Model Outboard Motor "Seki," electric, reversible, 4 x 2 inches, perfect workmanship; also Speed Boat to match. Write—LEGGE, 51, St. John Street, Oxford.

1" Water Gauge, 5s.: Cylinder Lubricator, 3s. 3d. Drain Cock, 3s.—THOS. McCracken, 388, Main Street, Rutherglen.

Wanted, Steam Locomotives, finished or unfinished, any condition, any gauge; also Road Locomotives, parts, castings, etc.; complete garden layouts bought.—Box No. 4029, MODEL ENGINEER OFFICES.

Sale, 6 c.c. Baby Cyclone Engine, propeller, switch, components, perfect, £8 10s.—7, Gillingham Road, London, N.W.2.

3" x 1/2" D.A. Vertical Twin Steam Engine, new, £8 10s.—QUINSEY, 222, Ashridge Way, Sunbury-on-Thames.

Hexagon Head Turned Steel Screws, 5 to 10 B.A., 6s. gross; Nuts, 5 to 7, 3s. 9d.; 8, 2s. 2d.; 9, 4s. 8d.; 10, 5s. 6d. gross; Free-cutting Stainless Steel, 1/2", 6d.; 5/32", 9d.; 3/16", 10d.; 7/32", 1s.; 1/2", 1s. 1d.; 5/16", 1s. 9d.; 3/8", 2s. 3d.; 7/16", 2s. 9d.; 1/2", 3s. 4d.; 5/8", 4s. 6d. foot; Stainless Steel Balls, 3/8", 5d.; 5/32", 6d.; 3/16", 7d.; 7/32", 8d.; 1/2", 10d.; 5/16", 1s. 8d. dozen. Materials second to none. Over 300 sections in stock. C.O.D. orders taken. All plus postage.—NLMES, 115a, Lady-smith Road, Enfield.

Australian Designs, Engines, Locomotives, catalogues 2s.—BOLTON, 70, King Street, Sydney.

Small 4 V. Electric Motor, unused, 12s. 6d.; 6 Piston Rings, 1" x 1/16", ground to 1/2 thou., 2s. 6d. each; 1 c.c. Petrol Engine, no coil. Offers.—133, Chevalier Avenue, Coventry.

Stuart No. 9 For Sale. Offers over £15.—3a, Harpsfield Broadway, Hatfield, Herts.

Wanted, Steam Engine, two cylinders, 2" bore by 3" or 4" stroke, double acting, reversing gear, marine type engine if possible, or blueprints or castings, machined or rough, for above.—DALY, 406, Dewsbury Road, Leeds 11.

Wheel Castings, good range of sizes; "Lord Nelson" parts, gauge "O" track. S.A.E. lists.—KENILWORTH WORKING MODELS, 90, Warwick Road, Kenilworth.

Segull Engine, 12.81 c.c., 14 Aluminium Alloy Castings, 37s.; Drawings, Assembly and Wiring Diagram and Instructions, 8s. Post and packing 9d.—4 B. BREAKS, 8, Lynmouth Road, Aigburth, Liverpool.

Brass Boilers fitted with filler cap and safety valve, 2 1/2" diameter, 4 1/2", 25s.; 5 1/2", 26s.; Brass boiler tubes with two pressed flanged ends, 2 1/2" diameter, 4 1/2" and 5 1/2" long, 7s. 6d. each; Filler caps, 1s. 6d. each; Safety valves, 4s. 6d. each; Brass tube.—KINGSTON MODEL SUPPLIES LTD., 6, Thames Street, Kingston-on-Thames.

ELECTRICAL EQUIPMENT

Electradix Bargains include:—

Dynamo and Motor Generator Bargains. G.E.C. double current Dynamos, 6 volts, 5 amps., 600 volts, 80 m.a., ball-bearings, 17 lb., as new, 37s. 6d., carriage paid, 5s. refunded on returned packing case.—Below.

Small D.C./D.C. Motor Generators by leading makers for use in Radio Receivers to take the place of H.T. battery, 6 volts input, 110 volts, 15 m.a. output, or 12 volts input, 230 volts, 30 m.a. output, £3 15s., weight only 5 1/2 lb., size 5 1/2" x 3 1/2" x 3 1/2", model finish, ball bearings, 2-comms., 2 separate windings, waterproofed.—Below.

Transformers, 3 K.W. Crypto, 230 volts to 115 volts, 28 amps., £9 10s.; to small Bell Transformers, 230/3/58 volts. 7s. 6d. Transformers for Rewind, 3 K.W. with stampings, 4 1/2" x 6" x 7 1/2", windings damaged by blitz, weight with damaged wire, 65 lb., 45s., carriage extra.—ELECTRADIX, 214, Queenstown Road, London, S.W.8.

Amplifiers, 20 watt, £9; 30 watt £10; super 50 watt, £25.—BRITISH SALES COMPANY, 109, Hurst Grove, Bedford.

Aeromite Coils from the makers, 2 oz., 2 volt, no booster, vacuum pressure varnish impregnated. Every coil guaranteed.—COONEY, Todd Lane, Lostock Hall, Preston.

Interesting Bargains. Motor Alternators, 110 d.c. to 230 v. a.c., 200 watts, perfect condition, £11 15s. each; Semi-portable Petrol Lighting Set, 4 h.p., 35 v., 35 amps., new condition, £48; Marine Petrol Engine, 4 h.p., type B1, perfect condition, less mag., £10; Mains Transformers, output 12 v., 4 amps., 30s. each, all carriage paid.—N. R. BARDWELL, 473, Abbeydale Road, Sheffield.

D.C. Motors, 1/2 h.p., 200/250 volts, £8 18s. each; 3/4 h.p., £3 15s. each. Many others.—JOHNSON ENGINEERING, 319, Kennington Road, S.E.11. RELiance 1412/3.

"Pigmy" Electric Motors for Boats, Fans, etc., 2 1/2 in. x 2 in. x 1 1/2 in. 10 ozs. A.C./D.C., 4/24 volts. Flashlamp Batteries, Accumulators, Transformer. Send 25s. 7d.—EDUCATIONAL MANUFACTURING COMPANY, 197, Brownhill Green Road, Coventry.

GENERAL

Watch and Clock Making. If interested you can get all tools and parts, also wheels cut from—JOHN MORRIS, 64, Clerkenwell Road, E.C.1. Regret no posts or lists, only counter service at present.

Watchmakers Demobbed need Lathes to start work again. John Morris (Clerkenwell) Ltd. will pay high prices for Lathes by Lorch, Boley, Wolf Jahn, and American and Swiss makes.—64, Clerkenwell Road, E.C.1. CLE 6077.

Toymaker's Super Casting Mould for Lead Toys. Over 200 latest designs. Fully illustrated catalogue, 6d. Postal Order with large stamped addressed envelope.—GASEE, 7, Stradbroke Road, Highbury Barn, London, N.5.

Precision Fitting, Turning, Motor repairs carried out by Ex Naval Engineers. Quotation against drawing. S.A.E.—ELECTRO ENGINEERING, 3 Bungalow, Baldry Gardens, Streatham, S.W.16.

Detail Drawings, Assemblies, Tracings. Efficiently drawn up from sketches and notes.—DIMMOCK, 25, Chilworth Street, W.2.

Exchange "Exacta" Reflex Camera, Jhaage 3.5 lens, E.R. Case and Electric Meter, both perfect, for 3 1/2" 4" Lathe. Perfect condition essential. S.A.E.—HERBERT, 28, Tower Street, Leicester.

Car Thermometers pre-war (Smiths) dash reading, flush fitting, matching other dash instruments. The most useful car instrument. Reading 90-212 Fahrenheit, 35s., new and complete.—TEDDINGTON ENG. CO., 29, High Street, Teddington, Middlesex.

Accurate Model Blueprints! "Humber" Ship Drawing Catalogue, 4d.; Agent "Skinley" Railway Blueprints, Catalogue 4d.—HUMBER, 60, Tudor Road, Edmonton, N.9.

Blueprints or Problems, results are obtainable with working drawings by Underhill, Wilson, Greenly, Skinley, Stuart Turner, and advice from a practical model engineer; latest being Racing Yacht, Centre Flue Boiler, Blowlamp, Liner "Stirling Castle", Destroyer "Cossack", Clipper "Stonehouse." Quotations 2d. stamp. Advice 3s. 6d.—WILSON, MACDUFF & CO. LTD., 5, Victoria Street, London, S.W.1.

For Quick Sale: MODEL ENGINEERS, bound Vols. 5, 6, 7, 8, 9, 11, 12, 13, 14, 15; MODEL ENGINEERS, unbound Vols. 21, 26, 27, 36 to 53, 56, 57, 64 to 85, and 87; "Ships and Ship Models," Vols. 1 to 8; "English Mechanics," 1935 to 1939; full set, "Twenty Years After"; 65 "Practical Engineer," 1945-1946. Offers to—J. FLINTOFF, 18, Avondale Road, Lancaster.

Wanted, Lowke Catalogues, 1908 to 1914.—W.G., 77, The Avenue, Muswell Hill, N.10.

Wanted, Typewriter, any make, any condition; also A.C. Battery Charger.—Box No. 4025, MODEL ENGINEER OFFICES.

Wanted, Model Makers in metal, for full, part time, and home work, for ships and aircraft fittings.—Box No. 4026, MODEL ENGINEER OFFICES.

Best Offers. "Model Engineer," 19 copies, August-December, 1944; 61 copies March, 1945, to May, 1946; 79 copies, 1931-1932. All perfect condition.—LOYD, 11, Windsor Avenue, Anlaby, E. Yorks.

Advertiser, Now Demobilised, forming company to produce model engines, steam or petrol, and other mechanical or electrical toys, wishes to obtain drawings, patterns, castings, etc., or arrangement with practical designer. Apply—Box No. 4028, MODEL ENGINEER OFFICES.

Sale, Set Castings for 5.8 c.c. engine, plug, coil, 50s.; Table Mike with 30 ft. wire, 10s.; Vacuum/Pressure Gauge, 3 1/2", 60 lb., less glass, 20s.—WILSON, 59, Worthing Road, Basingstoke.

Winfield Bench Lathe, 4 1/2" Screw-cutting, £30; Stuart Turner Direct Lighting Plant, 110 V., 500 W., £25; Jap. Stationary Petrol Engine, 2 h.p., as new, £18 10s.; Dynamo, 240 V., 4 A., £4 10s.; Higgs A.C. Motor, 1/3 h.p., 230 V., £5.—AUSTIN, 26, Abercrombie Street, Chesterfield.

Compact All Metal Stereoscopic Camera, twin Zeiss Tessar lenses, automatic plate changer, viewer, leather case. Exchange for good 2 1/2" 3 1/4" Lathe.—GRAY, 22, Court Road, Ickenham, Mdx.

Sale, "Model Engineers," Vols. 63, 64, 66, 67, 69 to 73, all complete, 65, one missing; Bound Vols. 15, 16, 17. Offers to—E. HOLDEN, 76, Fielding Lane, Oswaldtwistle, Accrington.

Can Anyone Sell or Loan me copies Nos. 2332, 2333, 2335, of MODEL ENGINEER? Please write—WADSWORTH, 14, Willenhall Road, Woolwich, S.E.18.

Wanted, Volumes 82 and 83, "Model Engineer," bound or unbound, good condition.—CLARKE, 17, St. Nicholas Street, Scarborough.

Wind Chargers. Slow revolving Propeller, 3 1/2 to 1 geared shaft drive to Car Dynamo at ground level. No sliding contacts. Set of clear Diagrams and Instructions for building entirely from easily obtainable parts. Price 3s. 6d.—M. BARHAM, Les Buttes, Torfeval, Guernsey, C.I. (posted promptly).

the walls, that access to the corners was almost impossible. And it subsequently transpired that the corners were not right-angles; as the size of the smacks increased, the shed was not large enough, and to meet the demand for additional space a cave-like excavation was made at the landward end. As this proved insufficient, part of the wall at the seaward end was removed and a wooden "lean-to" was constructed, fitted with two large doors. This erection was not placed in the centre of the front elevation, thus providing additional variety architecturally and a good deal more work for the amateur draughtsman, who had to undertake extra pilgrimages from Bowness-on-Windermere to Arnside on the Kent estuary—no great distance as the crow flies, but a round-about road on a push-bike, when war-time had withdrawn most of the bus services.

Constructing the Model

The model was commenced by dowelling together three pieces of yellow pine to form the floor of the shed, the middle one being reduced to form the sloping well. The landward wall, pierced for the fireplace and the cave-like recess, was screwed to the back, and the two side walls, one cut out for the window and the other for the windows and door, were firmly glued and screwed into position. They were composed of two layers of pine, the grain of the one being vertical and of the other horizontal, then glued together. Battens were secured across underneath the floor to carry what was to be the yard and roadway to the left of the workshop, and the strip of rough hillside to the right. The landward wall of the yard, which is curved, was built up of pieces of yellow pine, on the lines of a railway sleeper fence, and "secret nailing" was used. In front of this was glued and nailed a piece of round wooden cheese box, which gave the appearance of bulges in the wall.

The foundation of the road running up to the left of the site and the footpath at the back were next screwed on and supported by wooden brackets, while the wall at the far side of the footpath was fixed to this shelf-like structure. Very few nails were used in the model, as screws hold so much better and it was a great advantage to be able to take the model apart to facilitate later operations.

Experiments on Stonework

The stonework of the walls is rough limestone and it proved no easy task to reproduce this in the model. Experiments were made with various materials, including plaster of Paris, Plasticine, and even fragments of limestone itself, but the best results were achieved by using small, roughly torn pieces of cardboard, fixed to the wood background with paperhanger's paste. Tearing the cardboard proved to be a slow and painful business, but mechanical aids such as pliers left unsightly impressions on the fragments. Fixing the pieces in position was likewise a sore trial, as one part refused to adhere to the wood, while the other, having absorbed the paste through and through, refused to leave the fingers. It was found a help, especially at exposed corners, to hold the slip of cardboard in position with fine pins until the paste had set. In the beginning

it seemed desirable to make the adjacent pieces fit fairly accurately, but later it was found that quite as good an appearance resulted from a slight overlap from one to the other. The crenellated effect at the top of the walls was produced by fixing fragments of cork, trimmed roughly to suitable size and shape, with panel pins and adhesive to the appropriate positions, coating them with glue or paste and dusting them over with powdered Arnside stone.

Little need be said regarding the construction of the model boathouse, which was fairly straightforward, if such an expression can be used for a building of so many angles and unexpected irregularities, but the roof did present a special problem, as it had to be removable in order to afford access to the interior for the installation of the partially completed smack, the many loose parts, the tools and other fittings.

Roofing Material

The roof of the workshop is, of course, covered with corrugated iron and lit by skylights, but, had this been done on the model, practically no view of the interior would have been possible. It was therefore decided to indicate the nature of the roof by fixing a few sheets at each end of the roof beams, leaving the rest open. What material was to be used to simulate the corrugated iron? Corrugated paper was too clumsy, and aluminium sheeting from the running-board of a car was not much better. Nothing one could buy had the right number of "corrugations" per sheet, so the only solution appeared to be to swage up some thin copper. A piece of hard wood, free from any knot, was selected, the right size to scale of a normal sheet, and carved with the requisite number of grooves and rounds per inch. Using this, a zinc die and tin counterdies were prepared. With these it was hoped to swage up very thin copper cut to size, the force being supplied by pressure in a leg-vice, but it was not sufficient, and eventually the desired result was obtained by using a press normally employed for similar operations in the Liverpool School of Dental Surgery. Holes were easily drilled through the sheets thus prepared, and they were then fixed to the wood framework with small pins.

The benches and shelves were next pinned and glued into position, the steam-chest fixed, and slots made to receive the legs of the grindstone and the base of the bandsaw. The desk and shelves of the office among the beams, with its boarded sides, made it more difficult to remove the roof, but it was accomplished after easing here and there.

Doors and Hinges

The doors themselves presented no difficulties, but it was not so easy to provide hinges, and in the end it was necessary to make them. As they were all strap hinges, the following *modus operandi* was used. A strip of thin sheet brass was cut about one-sixteenth of an inch wide and one inch long, and trimmed with wedge-shaped ends. This was bent over a pin, about three-quarters of the way, the remaining quarter length being folded over and pressed down in a vice. The pin was then withdrawn and, with

chuck, and skim any roughness off the outside and end; then part off $\frac{3}{8}$ in. from the end. Reverse in chuck, and turn down $\frac{3}{8}$ -in. length of the other end to $\frac{1}{8}$ in. diameter, leaving a piece $\frac{1}{8}$ in. wide, of the full $\frac{3}{8}$ in. diameter of the original piece. The turned-down part has to be screwed 5-B.A. or $\frac{1}{8}$ -in., but leave it until the lever is made, so as to use same as a guide to get the exact length of thread. Now file a series of ratchet-teeth all around the projecting flange, using a small three-cornered file. It doesn't matter about their all being exactly even, as long as they are not ragged, and the buttress face is radial to the centre. Be careful you file them the right way; in the illustration showing the ratchet-wheel broadside on, the hexagon hole in the box-spanner is facing you. The teeth can, of course, be milled in the usual way by anybody who has the necessary appliances, such as a milling machine with dividing head, or a wheel-cutting attachment for the lathe; but the filed teeth will be found quite satisfactory for those who can only cut them by hand.

The operating-lever is in two parts, the shorter one being pivoted on the $\frac{1}{8}$ -in. stem of the stub box-spanner, and carrying the pawl. It is made from a $1\frac{1}{2}$ -in. length of $\frac{1}{2}$ -in. by $\frac{3}{32}$ -in. mild-steel rod. Drill a No. 30 hole at one end, and a No. 41 hole at the other. About $\frac{1}{16}$ in. below the No. 30 hole, drill one with a No. 48 drill, and another still at $\frac{1}{16}$ in. below that; tap them $\frac{3}{32}$ -in. or 7-B.A. Chuck the box-spanner part again, and slip the No. 30 hole in the lever over the projecting end; then put a 5-B.A. die in the tailstock holder, and run it right up to the lever. This will enable it to cut just the correct length of thread, for the nut to be screwed up tight without jamming the lever.

The pawl is filed up from a piece of $\frac{1}{8}$ -in. flat steel, either cast or mild, to the shape shown in the illustration, and drilled No. 40 for the pivot-screw. File a shallow groove, say $\frac{1}{16}$ in. wide and deep, in the back of the hump, to keep the wire spring in position. The spring is a short bit of 20-gauge wire, steel or hard brass, one end bent into a little ring and secured to the lever by a screw in the lower hole. The pawl itself is pivoted on a screw made from a bit of $\frac{3}{8}$ -in. or $\frac{1}{2}$ -in. round steel. Chuck it in three-jaw and turn down $\frac{1}{4}$ -in. length to a full $\frac{3}{32}$ in. diameter, so that the pawl slides on easily; put it on, and run a $\frac{3}{32}$ -in. or 7-B.A. die up to it, same as described above for the lever. Part off to leave a head about $\frac{1}{8}$ in. in thickness, and slot it with a hacksaw.

Before assembling, harden the ratchet-wheel and pawl. If the latter is cast-steel, harden like a tool, and temper to brown; but if mild-steel, do both ratchet and pawl together. Just heat to bright-red, dip in casehardening powder (Kasenit, Antol, Pearlite or any other good brand), reheat until the powder fuses and the yellow flame dies away, then quench in clean cold water. If a file won't touch the hardened surfaces, pass them O.K. If it does, give them another dose of the same medicine; then assemble as shown. The joints must be perfectly free, and the spring should only press on the pawl with sufficient force to ensure it going to the root of each ratchet tooth.

The extension lever is made long enough to

project beyond the firebox when the spanner is being operated in the top corners. Use the same section metal as for the short lever; round off both ends, drill a No. 41 hole in one end, and loosely rivet it to the end of the short lever, so that the joint is quite free. As one of the old Brighton fitters used to say, "Don't forget to ile the jints," and the gadget is ready for use. The nuts should not be a slack fit on the threads, or the soft copper will readily strip. Put the box-spanner over the nut, work the lever up and down a few times, and the nut is well and truly screwed home.

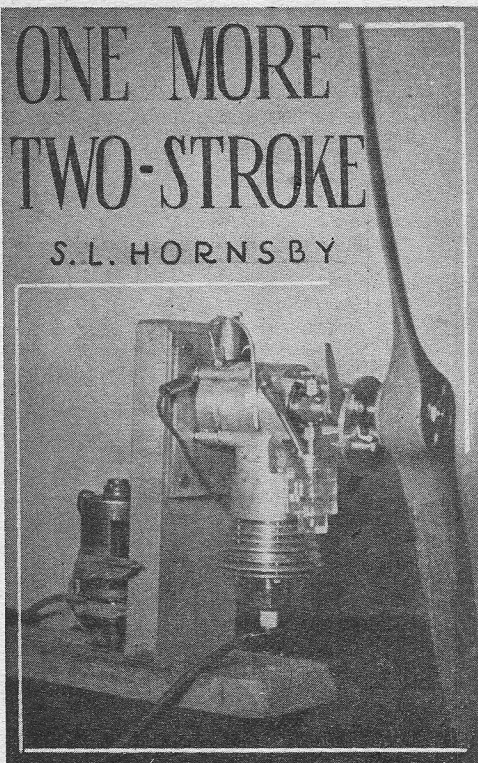
Rotating Box-spanner

For quickly screwing home the more accessible staynuts inside a firebox, I now use a "whirly-whirly," which is a stubby box-spanner with a little crank and connecting-rod attached to it. To make this joker, chuck a bit of $\frac{3}{8}$ -in. round rod in the three-jaw, and centre and drill as described above; then remove from chuck, and form the hole in a hexagon shape, as already mentioned. Re-chuck, skim off any roughness, and part off $\frac{1}{2}$ in. from the end; reverse in chuck, and turn down $\frac{3}{8}$ -in. length to $\frac{1}{8}$ in. diameter. Bend about $1\frac{1}{4}$ in. of $\frac{3}{32}$ -in. by $\frac{1}{4}$ -in. flat mild-steel, to the shape of an off-set crank, as shown in the illustration; drill one end $\frac{1}{8}$ in. and the other No. 41. Drive the spigot on the end of the box-spanner into the $\frac{1}{8}$ -in. hole, rivet over, and braze it. Alternatively, make a square hole in the end of the crank, same as we do with valve wheels, and file the spigot on the box-spanner to fit it. Pivot a 6-in. length of $\frac{1}{4}$ -in. by $\frac{3}{32}$ -in. steel rod to the end of the crank, by loosely riveting with a $\frac{3}{32}$ -in. iron rivet, and the gadget is complete. To operate, you simply put the box-spanner over the nut, and turn the crank by working the extension lever just like the connecting-rod on a locomotive.

A box-spanner with a fixed handle is also very useful, as it serves a double purpose, viz.: giving the final nip-up to a nut put on by either of the box-spanners mentioned above (if found necessary!) and holding the nuts in position against the stayheads to start them. This is simply a piece of $\frac{3}{8}$ -in. round steel about $\frac{3}{4}$ in. long. One end has a hexagon recess formed in it, as fully described above, and the other end has about 6 in. of $\frac{5}{32}$ -in. round steel screwed into it, and bent inwards a little. The nut is placed in the recess; the piece of screwed copper rod forming the stay is screwed through the tapped holes in wrapper and firebox, by aid of a tap-wrench. The nut is held against the end of the stay, as soon as same appears at the hole in the firebox, and the stay then enters the nut, running through it all the time the stay is being turned. When the stay is right home, the nut is locked against the copper plate by turning it with one of the spanners described above.

Holding-up Bar

A riveting-bar for holding up the stays whilst riveting over the heads outside the firebox wrapper, is made in a few minutes by cutting about an inch off the end of a piece of 1-in. by $\frac{1}{2}$ -in. iron or steel bar, and brazing it on to the side of the bar in the manner shown. This bar is held in



PERHAPS the photograph and description of a 15 c.c., 1-in. \times 1 $\frac{1}{4}$ -in. bore and stroke engine may be of interest to some readers.

The whole engine, with the exception of the crankcase, is made out of scrap. The crankcase was cast for me by the local foundry from my own patterns, and is in aluminium. The rear bearing

The cylinder, which is mild-steel (for want of better material) was a short length of bar I had by me.

The crankshaft, which is of the overhung-type, is fabricated in three parts. The shaft and crank-pin were once wheel studs in a "Bedford" wagon; the crank disc or web, is mild-steel. Each part was screw-cut, tinned with soft solder and sweated up solid, resulting in a crankshaft that will stand a considerable amount of wear. After the final sweating, the crank was set up on a faceplate jig and the crank-pin finally turned to size; the illustration will make clear the method by which the crankshaft was made.

The piston was die-cast in a home-made steel die—cast on the kitchen hearth. It is fitted with two $\frac{1}{8}$ -in. wide rings, also home-made, thanks to Mr. I. Bradley's articles on ring manufacture.

The connecting-rod is made from round dural bar; the ends are unbushed. Gudgeon-pin was once part of a "Bedford" wagon valve-stem, and is drilled for lightness. These valve-stems are particularly hard-wearing.

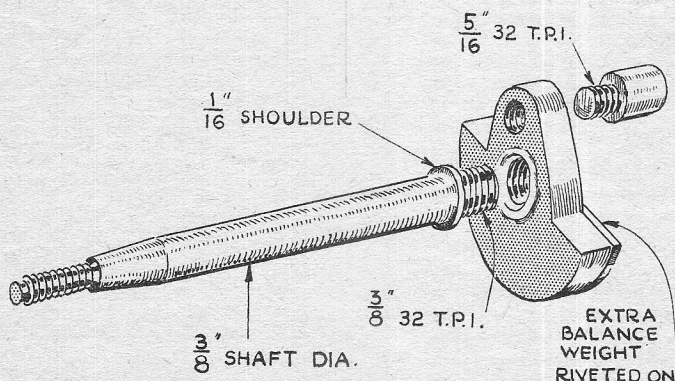
The cylinder fins are of aluminium, pressed on. Cylinder-head is detachable and, like the fins, is cast out of old "Leyland" wagon pistons.

The contact-breaker cam is of mild-steel spigoted and riveted to the airscrew-hub. The contacts were taken off a "Lucas" car distributor. The airscrew, 17 in. diameter, is made from birch, once a piece of furniture.

There are two petrol tanks, either of which can be used, as desired—one on the back of crankcase cover with filler, which can be seen on photograph. The other is a Perspex one, directly under the mixing valve. This is fabricated from three pieces of Perspex all screw-cut together and cemented with Durofix. It will be seen from the photograph that Mr. Westbury's two-stroke articles have influenced the design.

My method of making I.C. engines may not be first-class practice, but quite a lot can be made from the despised but valuable scrap-heap.

I might mention that none of the steel components was casehardened, but just left as found.



Dimensioned perspective sketch, showing the three parts of the crankshaft

is cast-iron made up out of an old "Bedford" wagon valve-guide, the front bearing being machined from a piece of phosphor-bronze bar from the scrap-box.

They are fairly hard to turn and difficult to get a tool-finish on; but high-speed and a smooth oil-stone make a good finish. The wearing qualities, in my opinion, are very good.

(after removing the piston). The effect was magical, the batch of engines ran so well, and at such a high speed, that we had to run them for nearly a week to get rid of the lubricant, as we knew we should get complaints if we allowed them to go out in this condition. We couldn't adjust the governor to reduce the speed by such a large amount and, the excuses we had to make for having the engines under test for so long! The governor, incidentally, is a flat disc with a spindle and control-spring regulated by a nut; when the engine went too fast and the suction increased, the disc was sucked in and opened the port at the rear of the cylinder, and the engine pulled up almost dead. It was only used to prevent the engine running away or as a convenient means of stopping by pressing the spindle in.

There is a short account of this hot-air engine in Professor Andrade's book on "Engines." My particular engine I espied in a marine store dealer's in Haslingden, Lancs., in 1920, and succeeded in knocking the price down to £6 and managed to have it packed and sent down to Dulwich. Some weeks later, I anxiously unpacked the prize and set it to work. I was very disappointed to find that it wouldn't drive my 75-watt dynamo at a sufficient speed to generate more than a volt or two. The engines, in new condition, developed about a third of horsepower, but I suspect the regenerator of mine requires overhauling; I have always been chary of taking the engine down, because of the danger of spoiling the large asbestos packing ring, which could not be replaced. I attempted to carry out a brake test on one occasion, but the result only came out at a ridiculously low figure of about one-hundredth of a horsepower, probably due to the unsteadiness of the spring-balance reading—the engine was obviously developing far more than this.

Finally, if and when I return to my home in Welling, Kent, I should be very pleased to show this historic novelty to "B. C. J.," if he should happen to be in the London district, or to any other interested reader by appointment.

Yours faithfully,

Carlisle.

J. F. PERRIN.

Ciné Design

DEAR SIR,—I was interested in Mr. Gauld's article on ciné projector intermittents, and appreciate the advantages of the Maltese-cross mechanism.

In order to be able to employ a larger sprocket, I see no reason why a four-point cross should not be used, and geared to the sprocket at the appropriate ratio. The sprocket could incorporate a spring-loaded friction device to nullify the effect of any backlash in the gears.

I have had no experience in this field, but put forward the suggestion for what it is worth.

Yours faithfully,

London, N.16.

J. KNIGHTBRIDGE.

Apologium

DEAR SIR,—Relative to the article of mine, published in your issue of May 23rd, about the Road Safety "Clover-leaf" Crossing, I said we were sorry to find there was no society in Doncaster. May I apologise through your paper, as

I have found that there is a society, and a very good one at that.

I have been accepted to the fold and I would like to rectify my mistake by saying that the society in Doncaster, although small, makes up for its size by keenness and friendliness.

Yours faithfully,

Doncaster.

H. BROWNLESS.

Old Telegraph Instruments

DEAR SIR,—The instruments illustrated on page 538 of THE MODEL ENGINEER for May 30th, appear to be a transmitter and receiver of a telegraph of the Wheatstone A.B.C. type. This system of telegraphy is described in *Telegraphy*, by Herbert. From memory, the system makes use, in addition to the instruments illustrated, of a hand generator of the type as is used in magneto telephone systems. When the system is installed the transmitters and receivers are set with the pointers opposite identical characters; on commencing to transmit, the transmitter handle is moved to the character to be signalled and the generator is steadily turned; this has the effect of sending a number of a.c. cycles to line. The number of cycles sent is controlled by the position of the transmitter lever. In the A.B.C., the instrument has a number of keys arranged around the dial of the transmitter and a pointer which is caused to travel round to indicate when transmission is complete for each individual signal sent. The receiver magnet steps the pointer round with the aid of an escapement and registers the incoming signals on a dial similar to that illustrated. The set shown appears to be the work of an experimental nature to overcome using a generator, and I suggest that each time the receiver magnet has d.c. current applied or withdrawn the escapement moves once, thus the 14 star-wheel moving round will send a series of make and break signals to line, in conjunction with the contacts mentioned in the article. These series will depend for their length on the distance the pointer has to move between the letters of the message sent. I would suggest that the signal shown at the top of the dial with a large cross is the signal to show an inversion from letters to figures and vice versa, or alternatively is the bell signal, in which case, the codes figures or letters would be sent to indicate the signal following.

It may be of interest to remark that the Wheatstone A.B.C. was, within its limitations of speed and lack of provision of a printed record, quite a reliable system, capable of working under very bad line conditions, and was used until the advent of the teleprinter, by various bodies who required a system of telegraphy which did not call for such a high standard of operating efficiency as is required to obtain maximum use of a circuit under morse working, and is not so costly to instal as other types of recording or printing telegraphs. The greatly improved method of operation of the modern teleprinter has rendered all this type of equipment obsolete and very seldom used nowadays.

Yours faithfully,

J. A. KING.

Welling Model and Engineering
(Experimental) Society

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Wanted, 5" to 6" Plain Lathe. Particulars to—READ, 80, Pondcroft Road, Knebworth, Herts.

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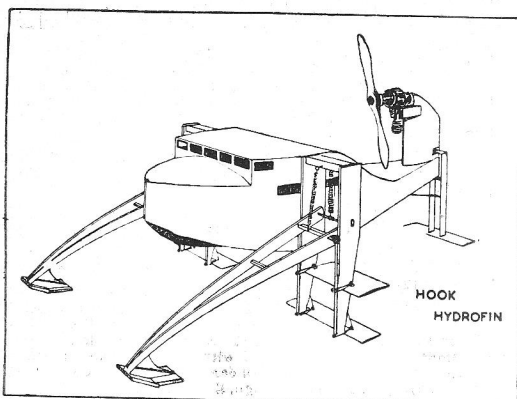
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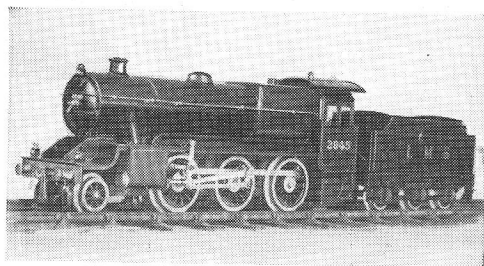
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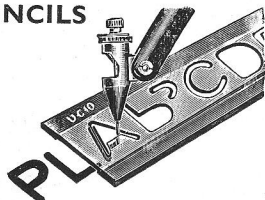
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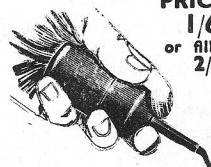
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